MINISTRY OF THE ENVIRONMENT

REGIONAL DATA PROCESSING STRATEGY

December, 1980

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MINISTRY OF THE ENVIRONMENT

REGIONAL DATA PROCESSING STRATEGY

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1.

INTRODUCTION

The Ministry organization includes six Regional Branches. The Regional Branch Head Offices are located in:

Southwestern	-	London
West Central	-	Hamilton (Stoney Creek)
Central	-	Toronto (Don Mills)
Southeastern	-	Kingston
Northeastern	-	Sudbury
Northwestern	-	Thunder Bay

In carrying out the programs of the Ministry, the Regional Branches collect a variety of data related to the Environmental Assessment and Planning, Environmental Control and Waste Management Programs.

In addition to forwarding much of this data to the Head Office in Toronto for Ministry-wide management purposes, the Regions also need to analyse this data to meet specific and often urgent needs, and to prepare reports on scientific surveys and studies.

Over the years various alternative data processing approaches have been employed to meet Regional needs, ranging from terminals connected into the Downsview Computer Centre to independent, on-site mini-computers, meeting with varying degrees of success.

In the Spring of 1980, it became evident once more that there was a need to assess the data handling requirements of the Regions. At the present time, all Regions have some form of mechanized data handling, but there was no ability for the Regions to directly access the Ministry Systems located in the Downsview Computer Centre.

It was obvious that if one or more Regions were to get a system that had this access, then there is a need for compatability within the Regions for the exchange of information both between themselves, and with the Downsview Computer Centre.

In addition, staff from all Regions spend a large amount of time manually acquiring data from our files to provide for Head Office information purposes and for assessments within the Region. For example the laboratory generates 1.75×10^6 pieces of information per year. Regional information pertaining to flows, tests on-site, air and water quality information, etc., generates an equal amount of information.

In order to review and assess both our present and future needs, a Committee was established, consisting of a representative from each Region, two representatives from the Systems Development Section of the Finance and Administration Division and a representative from the Laboratory Services Branch:

Bruce Boland	-	Southwestern Region
Lee Van Biesbrouck	-	West-Central Region
Don Ognor	-	Central Region
Dave Dillenbeck	-	Southeastern Region
Erv. McIntyre	-	Northeastern Region
Ray Poitvan	-	Northeastern Region
Wally Vrooman	-	Northwestern Region
Stewart Summers	-	Systems Development - Toronto
Gene Scanlon	-	Systems Development - Toronto

Over a series of meetings the following items were discussed:

- Ministry systems
- present procedures, shortcomings and needs
- objectives of the strategy
- alternative data processing approaches
- distributed data processing (DDP)
- costs of regional DDP approaches
- regional interface requirements
- costs
- plans
- policies
- management controls

From these discussions and other follow up activities the Regional Data Processing Strategy evolved as described in this report.

PURPOSE OF THE REPORT

The purpose of the report is to summarize the findings of the committee, to present a strategy designed to overcome the shortcomings of the present mode of operation with respect to Regional needs and to propose an appropriate course of action for the Ministry to take over the next three years in accordance with the strategy.

3.

CONCLUSIONS AND RECOMMENDATIONS

1. Over the last five years the Ministry has invested approximately two million dollars in the development of automated information systems concerned with the processing of sample results, air and water quality, utility performance, waste site, industrial liquid waste and industrial performance data. Although these systems address the major concerns of the Regions, the overall flow of data is orientated towards a centralized organization emphasizing head-office involvement and direction with regions playing more or less a spectator role. Modification of the systems to provide for greater operational involvement and access by the Regions will not only significantly increase their effectiveness to the Ministry as a whole but will also satisfy the more immediate data processing needs of the Regional Branches.

2. The overall development and implementation costs of providing Regional access to Ministry systems are estimated at:

   - Systems Development Services, to be provided by in-house resources..... $ 51,000

   - Equipment, including terminals, printers and mini-computers..... $ 335,000

3. It is recommended that system development and implementation costs be funded over the next two fiscal years as follows:

1981/82:	Systems Development Services.....	$ 42,000
	Equipment.....	275,000
1982/83:	Systems Development Services.....	$ 9,000
	Equipment.....	$ 60,000

4. The annual operating costs, including personnel, communications, computer processing and other (e.g. supplies) are estimated at..... $ 120,000

5. After reviewing the data processing alternatives available to the Regions a Distributed Data Processing (DDP) approach was selected as the most viable. Using this approach will provide the degree of flexibility required to meet the diverse equipment and processing needs of each Region.

6. It is recommended that a Data Processing Steering Committee be established with Head Office, Regional and System Development representation. This committee would be responsible for the development of policies, procedures and standards concerning the involvement and responsibilities of Head Office and the Regions with respect to development, operation and use of Ministry systems.

4.

MINISTRY SYSTEMS

One of the initial undertakings of the committee was to review Ministry systems now in operation and systems presently undergoing development or implementation. The objectives of this review were to:

- evaluate both the processing and data storage capabilities of each system in light of Regions needs

- identify those systems of most value to the Regions at this time

- outline the modifications needed to provide Regional access to each selected system.

As background to the review the development concept followed in the design of Ministry systems was also examined. This concept as well as the results of the review are discussed in this section and the next two sections of the report.

DEVELOPMENT CONCEPT

Over the years a systems reviewed concept has been formulated based on the following observations and conclusions:

- No division or branch can act independently of other divisions and branches in achieving its objectives: each division and branch depends on and is responsible to other divisions and branches for the interchange of data.

- Information does not relate generally to a single organizational unit: there are usually a number of units involved in the collection, processing and analysis of data, and the resulting information is used by numerous organizational units for various purposes.

- The ability to access various types of information and to bring those pieces of information together in various formats is becoming more important in formulating overall Ministry plans and following through on programs.

- An interchange of data between regions and head office will be necessary in order to develop overall, consistent approaches to the solution of problems.

- The sharing of responsiblity for collecting information and the recongnition of the needs of others to use that information can be an integrating influence in the operation of the Ministry.

- The objectives of the concept are to define, develop and maintain an overall Ministry Management Information System that:

- Promotes a better understanding of the inter-relationships and decision-making processes associated with the various information needs of the organization.

- Minimizes duplication of effort in both the development and operation of systems, stresses accuracy and consistency in data collection and presentation, and facilitates integration of data collection and presentation, and facilitates integration of data derived from various sources for various purposes.

- Encourages the pulling together of various organization units in the drawing-up of plans and the carrying out of programs.

- Emphasizes the need for conducting in-depth analysis of the data collected for planning, control and evaluation purposes, and facilitates access, wherever practical, across the Province to the data collected and the analysis tools available.

- Allows for a modular approach to be adopted in the development of information systems so as to facilitate control, permit flexibility in meeting urgent priorities, and minimizes the chances of being overwhelmed in the implementation of operation of systems and to formulate, maintain and follow through on plans that lead to the development and implementation of that concept.

CORE DESCRIPTOR DATA FILES

This concept has been partially implemented in the development of a number of major management information systems by including, as an integral part of each system, a Core Descriptor Data File. These Descriptor Files contain the following common codes and linkage keys which will eventually permit the integration of the individual systems into an overall Ministry Management Information System:

- Item identification codes (for example, sample station, utility, industry, waste site).

- Item location codes (for example, UTM, Latitude and Longitude, Hydrologic Codes, Ministry Region and District Codes, County/District Codes.

By means of the common Identification and Location Codes it will become possible to:

- access two or more of the individual systems data files,
- extract, from these files, related information on a given geographical area
- combine the information and produce a comprehensive report on the environmental conditions in the area in question.

A typical example of the type of information retrieval that would be available with system integration is as follows:

- extract suspended soil loadings to given stream from untility and industrial sources.

- extract ambient water quality values for suspended solids

- combine the information into a report that can provide a basis on which to analyse the environmental impact of the loadings on ambient water quality.

SYSTEMS SELECTED FOR REVIEW

Of the Ministry systems developed, seven were selected as being of the most value to the Regions at this time. More specifically, the consensus of opinion was that with suitable access modifications the systems' as designed, would satisfy most of the Regional high priority data processing needs for the foreseeable future.

Following are brief descriptions of each system:

(1) Laboratory Information System (LIS)

Samples are collected and submitted by Regional and Head Office Branches. Results are obtained and entered by the laboratories into the Laboratory Information System (LIS) and matched up with submissions. Upon completion of a submission analytical reports are distributed. At the same time, the sample submission and results data is stored in the Sample Information System. A more detailed description is provided in Appendix 1.

(2) Sample Information System (SIS)

Sample Results Records are passed from the LIS to the Sample Information System (SIS) where they are separated and stored on individual sample master files related to specific Ministry programs or sampling studies (eg. Utility Operations and Great Lakes). Each system user is then responsible for maintaining and retrieving data from their own sample results master file. A more detailed description is provided in Appendix 2.

(3) Air Quality Information System

The System is used primarily to process and analyze the concentration of various air contaminants measured at locations scattered throughout the Province of Ontario. A substantial portion of the air quality data and almost all the meteorological data is acquired through a telemetering system on a real time basis. Presently, the system processes information on approximately 140 different contaminants including the meteorological measurements which are identified by a set of common codes. The system reports on the ambient air quality levels in the Province and assists the management in determining the compliance of the am-

bient air quality levels with the criteria levels for desirable air quality set under the Province's Environmental Protection Act 1971.

The system also provides a Province-wide inventory of ambient air quality and meteorological measurements. This data is available to universities, public and private agencies and to the general public on request. A more detailed description is provided in Appendix 3.

(4) Utility Performance Monitoring System

Plant operations are responsible for taking and sending samples to Ministry Labs for analysis as well as recording of plant monitoring information. The plant monitoring data and sample analysis results are sent to Regional Offices where they are examined, compiled and forwarded to the Pollution Control Branch. The Pollution Control Branch prepares the data for input to the Utility Performance Monitoring System. After the systems files are updated plant operational reports are given to the Pollution Control Branch who distribute them to the Regional Offices. A more detailed description is provided in Appendix 4.

(5) Waste Site Information System

Waste site certification documents are sent from the Regional Offices to the Environmental Approvals Branch where they are prepared for input to the Waste Site Information System. After the master files have been updated the Waste Site Descriptor Reports are distributed back to the Regions by the Environmental Approvals Branch. A more detailed description is provided in Appendix 5.

(6) Industrial Liquid Waste Waybill System

Company representatives and Waste Haulers complete separate portions of Liquid Waste Way Bills and send them to the Waste Management Branch where they are input to the Industrial Liquid Waste Waybill System. Regional reports are then sent back to the Regional Offices who are responsible for taking the necessary action on non-reconciled shipments of waste. A more detailed description is provided in Appendix 6.

(7) Industrial Performance Monitoring System

The system processes data submitted by Ministry staff identifying, locating and describing industrial plants and various control points within plants where monitoring information is required. These control points may be in-plant sample points, discharge and emission points, intermediate control points, water intakes, etc. Each record contains data on operation periods, disposal methods, sampling programs, parameters to be tested for, result limits, etc.

The system processes data submitted by companies on all parameters associated with each control point in a plant in order to arrive at monthly loadings and concentrations. A more detailed description is provided in Appendix 7.

Although the above systems were designed in accordance with the systems development concept, in actual operation a number of shortcomings have become evident, particularly with respect to the regional flow of data both into and out of the computerized portions of the systems. These shortcomings are detailed in the next section of the reports.

5.

SHORTCOMINGS

As outlined in the introduction the volume of information being generated throughout the Ministry is enormous. At the present time a number of Ministry systems designed to process this information are being operated by Head Offices Branches. However, bridges are now necessary so that the data stored in Toronto can be utilized and manipulated by the Regions to satisfy their processing needs. In addition, some Regional data that is being provided to Head Office is handled by non-technical people who cannot apply adequate verification as to the accuracy of this data before entry to the systems. This has resulted in a reduced confidence of the stored information on the part of Regional staff.

Some of the more pertinent problems may be summarized as follows:

- time lag between time data forwarded to Head Office and time reports received in Region
- erroneous and missing data
- report inadequacies
- difficulty in satisfying special requests
- difficulty in accessing data and programs located at DCC
- high costs of transmission between Regions and DCC
- programs available in "Head Office" systems meet only some of the Regional needs
- limited graphical capabilities of "Head Office" systems
- confusion concerning availability, advantages and disadvantages associated with various data processing technology approaches
- lack of communication between Regions and Head Office concerning needs and solutions.

Although many of the systems in Toronto are very good they do not, at the present time, have the capacity to permit the exchange of information between Regions and the Head Office on a rapid basis. Retrieval and manipulation by the Regions is not possible. Many of the Regions are developing their own air quality data networks. An extension of this into the other Regions would mean that the air resources would not have to read the charts that are currently submitted from some of the Regions and would also mean that the data would be quickly available, rather than having the lag time necessary for the charts to be sent to Toronto, read, and the information returned to the Region. Current chart reading is manual and slow.

At the same time, very much data is being generated throughout the Regions for the Acid Precipitation In Ontario Study. Transmission of this information is slow and prone to errors, with too much paper being handled by too many people not knowledgeable about the problems. In addition, data on incomplete transactions on the weigh bill system is slow to cope with, since the data returns to the Region are by mail. This means follow-ups by the Regions are slow and corrections to the data are also slow. It means therefore, that the information maintained on the central record is not always even reasonably up-to-date.

There currently is a large duplication of effort because no bridges exist between the Downsview Computer Centre and the Regions. While the information may be available on the central computer, the Regions are required to obtain their data on a working basis from their manual files. On occasion, this means that the data being used by the two groups are somewhat different. It should be mandatory that a common data base is used by all groups so that the information disceminated to the public, is always up-to-date as possible, and absolutely correct. The Regions at the present time, cannot do any trend analysis, except on a manual basis. Much of the information maintained in the Region is in a raw form and cannot easily be manipulated to a desired form for the required uses such as, report writing, statistical analysis, etc.

Over the past year, because of the increasing need to provide information to senior management and the public, there has been a large increase in the amount of information requested by the Head Office from the Regions. Because the Regions do not have this data on an easily retrievable system, considerable manpower must be expended in gathering it and putting it into the format requeted by the Head Office Branch.

It must be acknowledged that data is not only generated by this Ministry but also by other Provincial agencies and the Federal Government. Certainly in many instances, it would be useful to have the data available from Environment Canada that could be integrated with our data, to enhance our data base.

In summary, the Regions have essentially been left out in terms of accessing in a efficient and reliable manner, the data banks that are in Toronto. Whatever progress Regions have made in mechanized data handling system, has been due to the Region's initiative and resourcefulness, without a great deal of thought being given to compatability and bridges between the Head Office uses and the Regional uses.

The future must be different. All Regions are in a severe manpower bind, where the demand for information is increasing, while the staff availability is decreasing. Mechanized systems once implemented and kept up-to-date by the individual Environmental Officer for the area he is responsible for, will ensure that the field people have confidence in the information and that the information is readily available for other's use. Compatability of hardware must be looked at to ensure that communications between each Region and between the Regions in Head Office can take place in a most efficient and effective manner. A system must be established for the exchange of program information, so that programs in use in any Region can be borrowed for use in the other Regions. By far the most important point though, is that we must be in a position to be able to provide correct detailed,up-to-date information, as quickly as possible, in order for us to be able to respond to the needs of our mandate.

6.

STRATEGY OBJECTIVES

After reviewing the selected Ministry systems and discussion of their shortcomings the major objectives of the strategy were defined as follows:

- to define the data processing needs and priorities of the Regions with respect to meeting major program objectives
- to identify equipment, staff and other resources required to meet regional data processing needs
- to outline requirements with respect to regional management controls and systems development procedures
- to propose a Ministry policy with respect to the access and use of Ministry systems information
- to develop a framework for assessing future needs of regions

7.

REGIONAL INFORMATION NEEDS AND PRIORITIES

After drawing up a set of objectives, each Region then provided a statement of their priorities.

Southwestern

With respect to the Utility Performance Monitoring System, staff has expressed dissatisfaction with the operation of the system and has a strong desire to enter the operating data and laboratory data in the regional office and provide whatever necessary data the Pollution Control Branch needs on demand. With this arrangement, staff is of the opinion that a higher quality product will be provided and will be more readily available to them. There is a need to access past records and, if possible, obtain discrete results for all data, rather than the monthly averages which are the only data presently available.

In summary, a reasonably sophisticated system is required to input, program, manipulate and plot data for several types of files.

In addition staff has identified the following computer filing systems that should be created:

1. A mechanical/electrical/maintenance file to inventory their equipment and to establish a maintenance program for the equipment.

2. A personnel file to list their staff specialties, courses attended, etc.

3. A file of design data for each project.

4. A file for requisitions and purchase orders.

In addition to the above files, staff wants to have the capability to manipulate the rate review programs, financial reports and the Utility Performance Monitoring System currently available in the Ministry.

With respect to the Industrial Liquid Waste Waybill System, staff had the following comments to make:

The present system for monitoring the transfer of liquid industrial waste requires that the waybill be submitted within one week of the date of waste transfer. If time is allowed for mailing the waybills via the postal system and for entry on the computer, the information will not be available for at least two weeks from the actual haulage date.

It is the opinion of the Southwestern Region Industrial Abatement Manager that a computer printout facility in the Region would not significantly improve the efficiency of the abatement function in dealing with the waybill system. The time difference between obtaining a printout from Toronto versus direct access to the region is only one of two days, which is probably not significant in regard to the time period involved with securing and assembling the waybills on the computer facility. It should be noted that the waybill system requires that all transfer slips throughout the province be submitted directly to one central receiving location (Toronto) and it therefore makes little sense to separate slips for mail delivery to each region from Toronto.

West Central

Sample Information System (SIS)

West Central Region staff feel that they could meet most of their present information needs with suitable access to the SIS system. This access would consist of a daily or weekly dump from SIS of sample analyses results generated by the West Central Region. Our sample submissions that will be processed by the LIS system have been set up with suitable client numbers to allow individual sampling programs (ie. Utilities or Routine Inland Water Quality Monitoring Program) or surveys to be easily sorted out. This data would then be stored in additional files for easy access and use by the Region. A printout of this data would be required for checking. Access to the system in this way would have a number of advantages.

1. Rapid checking and varification of sample results (daily printout).

2. Easy data manipulation for reports and studies.

3. Data presently stored in more than one system could be easily combined for report preparation.

4. Additional data could be easily added to the appropriate file.

5. Regional data could be added or deleted as required.

6. Rapid continuous access to our data would then be provided.

7. Provides redundency in case of system failure.

8. Also, existing systems would be required.

9. Historical data from SIS could be added in the future if feasible.

This system could be set up two ways:

1. Using the existing large Main-Frame computer at Downsview. This would require a Regional high speed printer with plotting capabilities and/or a low cost telephone hook-up. Sufficient data storage space and access would be required. Also, Head Office EDP support would be required for initial design and set-up of the system.

2. An in-house mini computer. This system would require direct computer to computer high speed communication. A wide format printer with plot capabilities and a large data storage capability (ie., disk). Weekly data dumps would be used to cut down on time charges. Head office EDP support would also be required for initial set up.

   The major advantage of the mini computer would be much lower operation charges ie., telephone connect time, computer connect time, CPU and storage charges. However, it would require a large initial capital outlay and an extra staff member to obtain maximum use.

Either of these systems, if the required hardware and software and data access could be provided would be extremely useful to the Region. If sorting into pre-selected categories could be provided on a weekly basis prior to dumping to the Regional system, then additional manpower would not be required. Additional usage and creation of systems that require regional data input would require additional staff. The overall benefit and useability will depend on staff time requirements that would have to be worked out.

At present, use of the Main-Frame facilities at Downsview appears to be the most logical choice for the West Central Region.

Industrial Liquid Waste Way-Bill System

Staff are in agreement with the analysis of this system as provided by the Southwestern Region. We agree that no real improvements in service will be realized by direct Regional access. The only way turnaround could be improved is by each Region entering their own Way-Bills which would require a change in policy and probably additional regional manpower.

Regional Priorities

Our main interest is focussed on three systems

1. SIS
2. ILWWS
3. IPMS

The people concerned with the other systems appear to be happy with the status quo.

Southeastern

Primary Need

Direct access to the LIS (Laboratory Information System) is seen as a major requirement. The ability to receive the Analytical Result Reports and the Management Reports from the LIS as well as the ability, for those Regions with a Laboratory, to input sample submission and result data directly into

the LIS will greatly enhance the immediacy of the data to the Regions. A necessary complement to this is the capability for direct access to historical data files contained in the SIS (Sample Information System). When these needs are met, the Regions will have an invaluable resource at their command and will be better able to meet their specific data needs.

Secondary Needs

Each Region has unique secondary information needs which are dependent upon Regional priorities and requirements. It is therefore important that the Regional Data Processing Strategy enumerate these and assign a priority to each, dependent on its potential benefits to other Regions.

These secondary needs include:

- access to the Utility Monitoring Information System for report retrievals and possibly data correction and data entry;

- access to the Industrial Liquid Waste Waybill System;

- access to the Waste Site Information System.

These needs should be reassessed and priorized annually by the Regional Data Processing Committee.

Northeastern

With respect to accessing current systems our priorities are as follows:

1. LIS/SIS
2. Air Quality Information Systems
3. Utility/Tummis
4. Industrial Performance Monitoring System (MOLDI)
5. Hazardous Contaminants Information System
6. Pesticides Information System
7. Waste Site Information System
8. Water Wells Information System
9. Industrial Liquid Waste Waybill System

We have a number of internal systems that we would like to have including maintenance and equipment files; personnel records; budget and acquisition control files; SES datahandling systems; So_2 monitoring system; etc. These will come when we get our "mini".

Northwestern

Due to our remote location and costs of data transmission, the major requirement of the Region was to have the capability within the Region to store and manipulate data for our many requirements. Thus, we sought and gained approval to lease a Hewlett/Packard system, including a 9845T with hard disc and graphics. We also included the option to be able to have direct access to Downsview Computer Centre or other computer centres as demands arise. Direct access to the LIS (Laboratory Information System) and SIS (Sample Information System) would be the ideal complement to this system. Having a Regional Laboratory also increases the need for access to the LIS. We also feel the Regional Laboratory should have the capability to direct the data not only to the LIS but also to the Regional System in order to deter further costs of data transmission.

Some of the programs which are being developed in the Region are:

1. Water Quality Monitoring

2. Industrial Performance Monitoring System

3. Acid Rain Data

4. Complaints

5. Control Orders

6. Utility Operations

7. Requisitions and Purchase Orders

The needs of each Region with respect to the Regionalization of Ministry Systems were then reviewed and an overall set of priorities agreed upon. These priorities may be summarized as follows:

- Laboratory Information System (LIS)
- Sample Information System (SIS)
- Utility Pollution Monitoring System (UPMS)
- Industrial Water Pollution Monitoring System (IWPMS)
- Industrial Liquid Waste Waybill System
- Air Quality Information System (AQUIS)
- Waste Site Information System

8.

ALTERNATIVE DATA PROCESSING APPROACHES

Three alternative data processing approaches which might be used to satisfy Regional information needs were reviewed:

- stand-alone mini-computer (located in the Regional Branches)
- central computer center (located in the Downsview Computer Centre)
- distributed data processing (with data processing equipment located in the Regions in communication with the central computer located in the Downsview Computer Centre and the LIS computer located in the Toronto Laboratory).

All the approaches have been used in the Ministry. Following are brief descriptions of their strengths and weakness.

Stand-alone mini computer

This approach combines the benefits of low computer processing costs with the heightened sense of independance, "instant" access, and control over priorities.

However, the high initial cost of purchasing or the steady monthly lease or rental costs, independent of usage, may prove burdensome and increase the risks of ventures not fully delineated and planned for. The limitations of mini-computers with respect to processing speed, storage capacity and software capabilities may necessitate additional expenditures. Also, because of the independence/isolation factor, additional hardships may be incurred with respect to systems development, management and operational control, data compatibility, and systems backup and continuity.

The types of applications generally suited for mini-computers have been outlined under section 45-2 of the Ontario Governments' Manual of Administration and are described under Category 1 in Appendix 8.

Central Computer Center

This approach combines the benefits of low initial computer equipment costs, which allow a user to grow with respect to the development of applications and the volume of work processed at a pace most suitable to the organization, with the wide range and variety of services offered and the large storage and fast speeds of the equipment used. Also, a certain degree of standardization is achieved and much of the housekeeping is taken care of through the use of a central computer service center.

However, as the work volumes increase so too will the monthly service charges. In addition, their is a certain amount of loss with respect to the sense of independence a user has and his control over priorities and schedules.

The type of applications generally suited for large computer mainframe processing are described under Category 3 in Appendix 8.

Distributed Data Processing

Through a Distributed Data Processing approach, the user may determine which functions can be best handled by the central computer center and by local, on-site equipment, and through the use of communication services make both pieces of equipment behave as one personnel computer center.

This approach can provide a very flexible means for meeting specific needs and characteristics while combining the strengths and minimizing the weakness associated with stand-alone mini-computers and large mainframe cental computer centers.

However, in order for this approach to work successfully, an understanding of all the costs involved and a committment to ensuring that the appropriate management controls and standards are in place is required.

Selected Approach

Based on this review it was agreed that the Distributed Data Processing approach would provide the degree of flexibility most suited to the diversity of Regional Data processing needs.

9.

DISTRIBUTED DATA PROCESSING

After selecting Distributed Data Processing as the most viable alternative the committee then reviewed in detail the various aspects associated with successful development and implementation of this approach.

DEFINITION OF DISTRIBUTED DATA PROCESSING

Distributed Data Processing has been described by a number of people in various ways:

- The general notion of a distributed system is that various elements of a data processing system can be partitioned into well-defined units that may be located at various logical sites and linked by agreed-upon protocols. Examples of distributed processing have many points of dissimilarity as similarity and reflect a diversity of system solutions to system problems. Distributed systems take different views of the distributable system components, of the essential shape of the system, and of the geographical proximity of nodes. Various choices are made concerning placement of data and programs, and the form and location of systems control.

  H. Lorin
  IBM Systems Journal
  Vol. 18/No.4/1979

- Distributed processing is an approach to computing whereby the data processing, data storage and systems development functions are distributed between a central data centre and one or more remote processing sites in the most appropriate manner. A data communications network is an essential element of such an approach as it connects various processing sites together so as to achieve an integrated systems capability.

  Ontario Manual of Administration

A computer-based information system can be broken down into the following functions:

- data acquisition
- input editing
- data manipulation
- master file updating
- data analysis
- output reporting
- program development

Each of these functions in part or in various combinations may be distributed to a local, on-site processor.

Any system that utilizes equipment located in different sites connected through the use of communication lines may be thought of as a Distributed Data Processing System.

The type of distributed data processing system chosen depends to a large extent on the needs of the application, the amount of data to be analyzed and stored, the communications involved and the degree of inter-dependency with other systems and units of the organization.

IN THE MINISTRY

In the Ministry we have a number of computer-based information systems operating in a distributed data processsing mode.

With respect to data acquisition, the Nanticoke Environmental Management Program (NEMP) uses data loggers to collect monitoring data from instruments located around Nanticoke and transmits this data continuously to a Data Aeneral Eclipse computer located in Toronto which produces alert type reports and model projections for research purposes. This information is then stored and periodically, once a month, transmitted to the IBM 370 installation in Downsview where the historical data base is located.

With respect to input editing, the EDP Operations Section of the Finance and Administration Branch is acquiring a key-to-disk data entry system from Northern Telecom which will be connected to the Downsview Computer Centre via a high-speed dedicated line. This system will be able to perfom various editing routines on input data locally that normally in the past would have been performed at DCC.

With respect to data manipulation, phase 1 of the Laboratory Information System (LIS) matches up results data as it becomes available with the original sample submissions to produce Analytical Result Reports for clients and a variety of Management Reports. Upon completion of sample submissions, the data is then transmitted to Downsview to update the historical data base used for client retrievals and analysis.

With respect to data analysis and output display, the Water Resources Branch now retrieves selected portions from their data bases located at Downsview and transmits these data sets over telecommunication lines to their progammable calcuators, terminals and minis for intensive analysis and plotting purposes.

In determining which functions in a system shall be distributed, a cost/benefits analysis is required comparing the two alternatives: execution at the central computer versus execution on a local device.

DISTRIBUTED DATA PROCESSING COSTS

In selecting the most appropriate D.D.P. approach, all of the costs, both capital and operating, must be considered. Following are the major types of costs:

Capital Costs:

- Equipment
- Operating Software
- Application Software Development
- Other

Operating Costs:

- Equipment Maintenance
- Operating Software Maintenance
- Application Software Maintenance
- Computer Processing at the Host or Cental Computer Center
- Communications
- Operating Personnel
- Other

Following is a brief description of each of these costs.

Equipment

The cost of equipment varies widely and depends to a large extent on the distributed data processing approach selected. For purposes of this study the approaches have been categorized as follows:

- dumb terminal
- intelligent terminal
- small mini-computer
- medium mini-computer
- large mini-computer

In very general terms, the costs of each of the equipment categories may be summerized as follows:

- dumb terminal - $ 3,000 to $ 9,000
- intelligent terminal - 15,000 to 30,000
- small mini-computer - 25,000 to 75,000
- medium mini-computer - 65,000 to 150,000
- large mini-computer - 150,000 to 350,000

Operating Software

The operating software associated with a manufacturer's equipment may be broken down into the following components:

- operating systems
- compilers
- utilities
- communication packages
- statistical packages
- scientific packages
- data base management systems

Some of these components are necessary in order to make the equipment work and may either be provided free or involve an additional cost.

Operating Systems may be batch, interactive, real-time or of a time-sharing nature, or a combination of the preceeding, and must be measured against the requirements of an application in order to ensure the equipment can do the job. Usually, the more sophisticated an operating system is, the more expensive the equipment required to run it.

Compilers that translate programmer coding into machine language may or may not involve additional cost. For example, some of the more common languages have resulted in the following changes:

- Cobol - $ 6,000 to $ 8,000
- Fortran - 4,000 to 6,000
- Basic - 2,000 to 4,000

Utilities such as sort, merge, copy, print, reformat, pack, purge can greatly enhance the capabilities of a system and may or may not be available.

Communication packages that allow computer systems/devices to transfer data to and from a central computer in a TSO or RJE - like mode involve additional costs in the order of:

- TSO - $ 1,000 - $ 3,000
- RJE - 1,000 - 3,000

Many of the various computer systems/devices can not transmit data in both TSO and RJE - like modes which represents a serious limitation.

Satistical and scientific packages may or may not be available. If available, they may cost in the order of $1,000, but be well worth the price.

Data Base Management Systems are available on some of the larger mini-computer, for example, the Image/Query DBMS is available on the HP 3000 and HP9845T.

However, these systems are usually expensive, in the oder of $7,000 to $15,000 and more, and involve a substantial systems development investment to implement. Only after the requirements of an application have been checked out throughly and only if those requirements demand such an approach should a DBMS package be acquired.

Application Software Development

The development of the application software may be broken down into the following phases:

- Phase 1 - Systems Definition
- Phase 2 - Systems Design
- Phase 3 - Systems Implementation

In accordance with the Spectrum Methodology, adaped by the Ontario Government, each of the phases may be broken down into the following sub-phases:

- Phase 1 - Project Proposal
  - Project Plan
  - User Requirements

- Systems Definition
- Advisability Study

. Phase 2
- Preliminary Design
- Detail Design
- Program Design
- Programming/Testing

. Phase 3
- Implementation Planning
- System Test
- Operations Turnover
- Start-up/Training
- Acceptance/Wrap-up

In some cases there may be Application Software packages already available which can be acquired. There may be a price attached, sometimes, depending on the complexity of the package, in the order of $10,000 to $50,000.

If there are no packages available, then the application software will have to be developed, either by in-house resources or by outside consultants. The use of outside resources cost in the order of:

. consultant	-	$ 200 - $ 400/day
. systems analyst	-	200 - 350/day
. programmer/analyst	-	150 - 300/day
. programmer	-	150 - 250/day
. trainer pogrammer	-	75 - 125/day

For example, in the case of a large mini-computer application, the following types of developmental charges may be incurred:

. systems definition	-	$ 20,000 to $ 40,000
. systems design	-	100,000 to 200,000
. systems implementation	-	20,000 to 40,000

In the case of a small mini-computer application, the developmental charges might be in the order or:

. systems definition	-	$ 1,000 to $ 5,000
. systems design	-	5,000 to 15,000
. systems implementation	-	1,000 to 5,000

Equipment Maintenance

Equipment maintenance may be purchased on a pre-scheduled basis or on a when-required basis. The pre-scheduled arrangement is more expensive, but depending on the nature of the application, may be necessary. In the case of a large mini-computer system, equipment maintenance may cost in the order of $10,000 to $25,000/year. In the case of a small mini-computer system, the cost may be in the order of $1,000 to $5,000/year.

Operating Software Maintenance

Software maintenance varies widely from system to system, manufacturer to manufacturer, and may range anywhere from zero to $10,000/year.

Application Software Maintenance

In most applications, modifications and extensions are required from year to year to meet changing needs. Depending on the scope and complexity of the application, anywhere from a half man-year to two or three man-years per year may be required costing somewhere between $10,000 to $75,000/year.

Computer Processing at the Host or Central Computer Centre

The type of charges incurred for computer processing services may be broken down as follows:

- connect time
- CPU/Processing
- storage
- other, such as type handling and printing

At the Downsview Computer Centre, the use of the following packages has resulted generally in the average hourly charges shown:

. Easytrieve	-	$ 7.00
. SPSS	-	10.50
. TSO/SPF	-	12.50
. APL	-	13.00
. IFPS	-	25.52

Communications

A local device, a terminal or a mini-computer, may communicate with a host/-central computer in a slow-speed, TSO-like mode or in a medium, high speed, RJE-like mode. The method of communication depends on the volume of signals/bits/-bytes/characters to be sent. For program development or inter-active processing, the TSO made is suitable. For transferring large volumes of records or print lines, the faster RJE mode is required.

A breakdown of communication costs for each region is provided, organized as follows in Appendix 9.

. TSO monthly costs at 1 hour/day

- Direct Distance Dialing

- Datapac

- Dedicated Time

. RJE monthly costs at 1 hour/day

- Infoexchange

- Dedicated Time

Operating Personnel

Depending on the size and complexity of the system, anywhere from a quarter man-year to two-man years per year may be required, costing somewhere between $4,000 to 40,000/year.

10.

REGIONAL INTERFACE REQUIREMENTS

The major elements involved in developing interfaces between the Ministry Systems and the Regions are:

1. System Software Connections.
2. Regional Data Processing Equipment.
3. Personnel.
4. Communications.
5. Central Computing.

A brief description of each of these elements has been prepared for each of the systems selected.

Laboratory Information System

1. No major modifications are required to add the Regional Laboratories onto the system.

   Approximately 2 man-months of training assistance will be required for each Regional Laboratory.

2. Hewlett-Packard Printing Terminals (TSO) will be required for sample submission, workstation control, run processing, result reading, approval, etc.

Depending on the printing volume a line printer may be required for the analytical reports and production reports as opposed to using the mails.

3. The human resources required for sample submission depends on the volume. The other input functions are carried out by the managers, scientists and technical staff.

4. A TSO communication link will need to be maintained throughout the day.

5. The size of the expansion in the Hewlett-Packard equipment depends on the number of terminals added, the increase in the data base required and the volume of data to be entered.

Sample Information System

1. No major modifications are required. Approximately 1 man-month of training assistance would be required for all six regions.

2. A TSO Terminals will be required for submitting retrieval requests.

   A line printer will be required for large volume printout as opposed to using the mails.

3. Present personnel will be trained to submit retrieval requests.

4. TSO communication link will be required, on an usage basis, for submitting retrieval requests.

   An RJE communication link will be required, on an usage basis for receiving printouts.

5. The Downsview computing costs for retrieval and report assembly depends on usage.

Utility Performance Monitoring System

1. Modification to the system software will be required to:

   - provide access to the data files.

   - provide monthly report printouts in the Regions.

2. A TSO terminal will be required for accessing data files and for initiating reports.

   A line printer willbe required for the high volume reports as opposed to using the mails.

3. Present personnel can be trained to submit requests and initiate printouts.

If in the future monitoring data is submitted directly from the Regions into the system, then considerable human resources will be required for data control and entry in the Regions.

4. A TSO communication link will be needed depending on an usage basis.

   An RJE communication link will be needed for high volume printouts.

5. The Downsview computing costs will depend on usage.

Industrial Liquid Waste Waybill System

1. With regards to the receiving of the Waybills and the inputting of the data the following problems exist.

   - In many cases the Generators are located in different Regions to the Receiver.

   - The Carrier of the wastes may be registered in one Region, picking up in a second and delivering to a third Region.

   - Often the wastes are picked up from several Generators before being delivered. The Generators could be located in different Regions to each other.

Due to this crossing of Regional boundaries it is desirable to have the Waybills mailed by the Generators and Receivers to a central point. Thus the inputting of Waybill data cannot be regarded at this time as a Regional procedure.

However, if a method to overcome the cross boundries problem that will allow for the entry of data by the Regions it would be a definite advantage to the Ministry.

However, with a terminal located at the Regional Offices they will be able to access the data directly for statistics and information required by them. No major modifications will be required to provide this access.

2. A TSO terminal with a keyboard printer will be required for submitting retrieval requests and for low volume printouts.

   A line printer will be required for volume printouts as opposed to using the mails.

3. Present personnel will be trained to submit retrievals and initiate reports.

   If, in the future, Waybills are entered from the Regions, then additional resources will be required.

4. A TSO communication link will be required on an usage basis for submitting request and low volume printouts.

5. The Downsview computing costs will depend on usage.

Waste Site Information System

1. Because of the low volume of data involved, when a Region certifies a waste site or notes changes in the description of the sites, it could input the data directly from the Region in addition to accessing the data and submitting retrieval requests direct.

   No major changes will be required.

2. A TSO terminal will be required.

3. Present personnel will be trained in entering updates and submitting retrieval requests.

4. A TSO communication link will be required on an usage basis.

5. The Downsview computing costs will depend on usage.

Industrial Performance Monitoring System

1. Prior to the suspension of the old computerized system the data was received at Head Office resulting in 3 major problems.

- In many cases the data was misinterpreted due to the lack of technical knowledge resulting in incorrect data being entered.

- Incomplete data was placed aside for follow-up and not acted upon.

- Because the data was submitted by companies directly to Head Office bypassing the Regions, and because of the time gap involved in producing the computer reports and distributing them to the regions, the use of the data for abatement purposes was nullified.

At this time a brand new look at the needs of both the Regional Branches and the Head Office Branches for a computerized system is required.

However, some of the characteristics of the new system may be summarized as follows:

- That the companies submit the data directly to the District Offices responsible for monitoring these discharges. This will ensure that the data is not misinterpreted and when incomplete the field representative will be able to contact the company directly. In addition being familiar with the company he will be able to recognize any problems or potential problems without having to wait for a computer printout.

- Due to the number of different types of industries, the various industry classifications used and the waste characteristics reported on a centralized point for the collecting and storing of data is therefore a necessity in order for the Ministry to be able to produce meaningful statistical and information reports on a Provincial basis.

- In order to avoid the problems and bottlenecks that occurred previously the Regions should be responsible for entering the data directly into the system thereby spreading the workload and reducing the Head Office time gap.

A major systems analysis, design and programming effort will be required to develop a new and comprehensive system.

2. A TSO terminal will be required for entering descriptive and monitoring data and submitting retrieval requests.

   A line printer will be required for high volume printouts as opposed to using the mails.

3. Additional personnel or/and significant portions of present personnel will be required for entering monitoring data.

   Present personnel will be trained to submit retrieval requests.

4. A TSO communication link will be required on an usage basis.

   A RJE communication link will be required, on an usage basis, for high volume printouts.

5. The Downsview computing costs for updating, report retrieval and assembly with depend on usage.

11.

COSTS

The estimated costs of developing and operating Regional interfaces has been broken down as follows:

Development

1. System Software Connections
2. Regional Data Processing Equipment

Operating

3. Personnel
4. Communications
5. Central Computing
6. Other

The following estimates are necessarily broad in nature and based on assumed workloads. They are intended to provide a good gauge on the type of commitment involved and required to build a successful Regional data processing environment.

DEVELOPMENT

1. Systems Software Connections

Estimates of the work required to provide direct access from the regions to the data stored in each of the systems discussed were prepared. This access would be used to initiate retrievals against sequential files resulting in subsequent retrieval reports and displays. However, because of the low volume of daily requests, less than a 1,000 inquiries per day, and the high cost of on-line storage, access would be limited to a batch processing approach providing same-day or over-night turnaround. Once the data had been retrieved, depending on the need and costs involved, it would be stored for on-line access and anaysis.

In the case of the Air Quality Information System a more detailed analysis will be required.

In the case of the Industrial Pollution Monitoring System the estimate provided relates to providing direct access to the data stored sequentially. Additional resources will be required to expand and modify the system to handle present and future needs. A seperate study to determine the objectives of the new system is currently underway.

Following are the estimates of each of the systems discussed in the report:

	Man-Months	Costs (in 1,000 of $)
- Laboratory Information System	6	18.0
- Sample Information System	1	3.0
- Air Quality Information System	3	9.0
- Utility Performance Monitoring System	2	6.0
- Industrial Liquid Waste Waybill System	1	3.0
- Waste Site Information System	1	3.0
- Industrial Performance Monitoring System		
- Direct Discharges to Water	3	9.0
(This estimate is based on salvaging some of the old computerized system)		
- Air Emissions		
- Land Disposal		
- Other		
	17	51.0

These costs would involve mainly the use of Ministry systems Development resources.

2. Regional Data Processing Equipment

- Laboratory Information System

  - 2 Hewlett-Packard Printing Terminals (TSO) and a character printer for Sample Submission and Workstation functions per Region..... 20.0

  - for 3 Regional Laboratories..... 60.0

- All other Systems

  - 1 TSO Terminal with keybord printer for data input, retrieval request and low volume printouts per Region..... 7.0

  - for 6 Regions..... 42.0

- All Systems

  - 1 RJE line printer for high volume printouts..... 15.0

  - for 6 Regions..... 90.0

  A mini-computer which combines input, storage, processing, high volume printout and graphic capabilities, potentially reducing operating costs involves a capital cost per unit of..... 75.0

OPERATING

3. Personnel

- Laboratory Information Systems

  - Depending on sample Submission volumes, additional resources may be required. Reassignment of present staff may be sufficient..... ?

- Industrial Performance Monitoring System

  - Input of monitoring data varies with regional volumes, for 3 high volume regions, 3 people may be required..... 50.0

  - For all other Systems, reassignment of staff can handle retrieval requests.

If data is inputted from regions on other systems, then additional personnel resources will be required.

4. Communication

TSO Mode (Modems + Usage)

Laboratory Information System (Dedicated Line)

	$/month
- London	140.
- Kingston	150.
- Thunder Bay	238.
	528.

Other Systems (in $/month)

	Dedicated Line	Datapac 20 Hrs/Mo	Mix
- Don Mills	48.	76.	48.
- Hamilton	121.	78.	78.
- London	140.	80.	80.
- Kingston	150.	95.	95.
- Sudbury	163.	104.	104.
- Thunder Bay	238.	254.	238.
	860.	687.	643.

RJE Mode (Modems + Usage)

All Systems (in $/month)

	Dedicated Line	Datapac 20 Hrs/Mo	Mix
- Don Mills	210.	332.	210.
- Hamilton	376.	332.	332.
- London	510.	368.	368.
- Kingston	584.	368.	368.
- Sudbury	689.	410.	410.
- Thunder Bay	1204.	530.	530.
	3573.	2340.	2218.

5. Central Computing (in $/month)

- for 3 high volume regions, monthly costs for each..... 1,500
- for 3 low volume regions, monthly cost for each..... 500

6. Other Costs

- such as supplies, etc.,..... 1,200

The overall estimate of Regional Data Processing cost may be summarized as follows:

Development:

- System Software Connections, in-house costs..... 51.0
- Regional Data Processing Equipment
  - LIS..... 60.0
  - Other Systems
    - TSO..... 42.0
    - RJE (at 15.0/Reg)..... 90.0
    - Mini-Computers (FOR 3 Regions/75.0)..... 225.0

Operating (Annual Costs):

- Personnel
  - LIS..... -
  - I.P.M.S..... 50.0
  - Other..... -
- Communications
  - LIS..... 6.3
  - Other - TSO..... 7.7
  - Other - RJE (1 Hr/Day for 6 Regions)..... 26.6
- Central Computer Processing
  - 6 Regions..... 72.0
  - Other..... 12.0

12.

IMPLEMENTATION PLAN

After reviewing the needs and priorities of each of the Regional Branches, individual Branch plans were drawn-up. An overall plan was then compiled and is described as follows:

System Software Connections

The estimate for developing the software connections using mainly in-house resources totals $51,000 with $42,000 being spent in 1981/82 covering six of the systems and $9,000 in 1982/83 covering the seventh system. An additional $5,000 of outside resources may be required in 1982/83.

Equipment

The plan calls for bringing all three Regional Laboratories on-line to the LIS in 1981/82 at a cost of $60,000.

TSO terminals with display screens and character printers totalling $35,000 will be required in five of the regions; two to be acquired in the last quarter of 1980/81, three to be acquired in 1981/82.

Two of the regions have expressed a need for high-volume printing capability requiring an RJE terminal in 1981/82 totalling $30,000.

Two of the regions have expressed a need to acquire a mini-computer for high volume printing, plotting and independent computing capability in 1981/82 totalling $150,000.

One of the regions has expressed a need to upgrade their capabilities in 1982/83 by acquiring a mini-computer totalling $60,000.

Personnel

Three of the Regional Branches have indicated a need to allocate personnel resources for the purposes of entering data, operating systems and developing applications totalling approximately $50,000 per year.

Communications

The three Regional Laboratories will require a dedicated TSO communication line each for all day access to the LIS beginning in 1981/82 totalling $6,500 per year.

TSO communication lines on a 20 hours/month basis for each region into the Downsview Computer Centre will be required beginning in 1981/82 totalling approximately $10,000 per year.

RJE communications costs based on an infoexchange rate of 1 hour/day have been estimated at $16,000 in 1981/82 building up to $23,000 in 1983/84.

Central Computing

The cost of the central computing service provided by the Downsview Computer Centre has been estimated at $38,000 in 1981/82 building up to $67,000 in 1983/84.

Other Costs

Two of the Regions have estimated other costs totalling $8,000 in 1981/82 building up to $12,000 in 1983/84.

Overall Implementation Plan

A breakdown of the overall Implementation Plan is provided in Exhibit 1.

The individual Regional Branch Implementation Plans are shown in Exhibits 2 to 7.

13.

POLICIES, PROCEDURES AND STANDARDS

In order to develop effective information systems that meet the most urgent needs of an organization and to minimize the risks associated with this endeavor it is essential that appropriate management controls be applied throughout the development process.

In the Ontario Government a number of management controls have been established to assist and protect the manager involved in developing systems. These controls, covering the acquisition of equipment and services, Project Planning, Systems Definition, Systems Design and Systems Implementation are described in the following documents:

- Ontario Manual of Administration covering Data Processing Equipment and Services (45-2); Management Consulting Services (50-3); Systems Development Services (50-5); Computer Systems and Data Processing (55-2); Computer Software and Program Languages (55-3)

- Management Guide to the use of:
  - Management Consulting Services
  - Systems Development Services
  - Data Processing Services

Spectrum Systems Development Methodology

The first two documents named above are concerned mainly with controlling the acquisition of computer equipment and the use of systems development services of non-government personnel. They provide a manager with an excellent set of rules to follow, particularly during the initial (or front end) phase of a system development project.

The third document the Spectrum Systems Development Methodology, provides a variety of management controls that are exercised throughout a systems development cycle. These controls can be summarized as follows:

Phase 1 - Systems Definition

- Work Request
- Project Proposal
- Systems Review Board (SRB). The role of the SRB in the Ministry of Environment is described in Appendix 10.
- User Requirements Definition
- Advisability Study (Feasibility Study)

If outside resources are required, and depending on the extent required, the following controls may be required:

- Request for Proposal (RFP)
- Vendor Selection Evaluation Report
- Contract

Phase 2 - Systems Design

- Appropriate Documentation and Sign-offs

Phase 3 - Systems Implementation

- Appropriate Documentation and Sign-offs

After reviewing the established government wide controls it was the consensus of opinion that, although they were necessary, additional policies, procedures and standards were required that related more specifically to Ministry Systems and Regional Data Processing needs.

With respect to each Ministry System, meetings between the Regional Branches and the Head Office Branches will be required to draw-up the appropriate policies and procedures to deal with:

- Systems Operation
- Data Handling
- Data Accountability

Also, with respect to each Ministry System, meetings will be required to determine appropriate standards associated with such items as:

- coding structures and codes
- input forms
- file descriptions
- report formats and contents
- documentation

With respect to regionally developed computer programs or mini-computer based systems appropriate standards and procedures will be required to ensure the dissemination of the information to the other regions as well as interested Head Office Branches.

The work required to determine the appropriate set of Policies, Procedures and Standards for the Ministry represents an on-going task necessitating the combined efforts of the Regional and Head Office Branches and the Systems Development Section of the Finance and Administration Division.

To carry out this work it is recommended that a Data Processing Steering Committee be established with appropriate representation.

EXHIBIT I.

Region: All Six Regions

REGIONAL DATA PROCESSING STRATEGY
COST ESTIMATES - DECEMBER, 1980

Interface Element	Estimated Annual Cost in $1,000s.				
	1980/81	1981/82	1982/83	1983/84	Total
1. Systems Software Connections:					
. Laboratory Information System (LIS)		18.0	-	-	18.0
. Sample Information System (SIS)		3.0	-	-	3.0
. Air Quality Information System (AQUIS)		-	9.0	-	9.0
. Utility Performance Monitoring System		6.0	-	-	6.0
. Industrial Liquid Waste Waybill System		3.0	-	-	3.0
. Waste Site Information System		3.0	-	-	3.0
. Industrial Performance Monitoring Sys.		9.0	-	-	9.0
. Water Discharges					
. Air Discharges					
. Land Discharges					
		42.0	9.0	-	51.0
2. Regional Data Processing Equipment:					
. TSO Terminals:					
. LIS		60.0	-	-	60.0
. OTHER SYSTEMS		35.0	-	-	35.0
. RJE Printers		30.0	-	-	30.0
. Mini-Computer		150.0	60.0	-	210.0
		275.0	60.0	-	335.0
3. Personnel:					
. LIS					
. OTHER SYSTEMS		47.0	50.0	53.0	-
4. Communication:					
. TSO					
. LIS		6.5	6.5	6.5	-
. OTHER SYSTEMS		8.0	10.2	10.2	-
. RJE		16.8	20.8	22.8	-
5. Central Computing - DCC:		38.0	56.0	67.0	-
6. OTHER COSTS		8.0	10.0	12.0	-

EXHIBIT 2.

Region: Southwestern

REGIONAL DATA PROCESSING STRATEGY
COST ESTIMATES - DECEMBER, 1980

Interface Element	Estimated Annual Cost in $1,000s.				
	1980/81	1981/82	1982/83	1983/84	Total
1. Systems Software Connections:					
. Laboratory Information System (LIS)					
. Sample Information System (SIS)					
. Air Quality Information System (AQUIS)					
. Utility Performance Monitoring System					
. Industrial Liquid Waste Waybill System					
. Waste Site Information System					
. Industrial Performance Monitoring Sys.					
. Water Discharges					
. Air Discharges					
. Land Discharges					
2. Regional Data Processing Equipment:					
. TSO Terminals:					
. LIS		20.0	-	-	20.0
. OTHER SYSTEMS		7.0	-	-	7.0
. RJE Printers		15.0	-	-	15.0
. Mini-Computer		-	60.0	-	60.0
		42.0	60.0	-	102.0
3. Personnel:					
. LIS					
. OTHER SYSTEMS		13.0	14.0	15.0	-
4. Communication:					
. TSO					
. LIS		1.7	1.7	1.7	-
. OTHER SYSTEMS		1.0	1.7	1.7	-
. RJE		4.4	4.4	4.4	-
		7.1	7.8	7.8	-
5. Central Computing - DCC:		6.0	10.0	12.0	-
6. OTHER COSTS		4.0	5.0	6.0	-

EXHIBIT 3.

Region: West-Central

REGIONAL DATA PROCESSING STRATEGY
COST ESTIMATES - DECEMBER, 1980

Interface Element	Estimated Annual Cost in $1,000s.				
	1980/81	1981/82	1982/83	1983/84	Tot
1. Systems Software Connections:					
. Laboratory Information System (LIS)					
. Sample Information System (SIS)					
. Air Quality Information System (AQUIS)					
. Utility Performance Monitoring System					
. Industrial Liquid Waste Waybill System					
. Waste Site Information System					
. Industrial Performance Monitoring Sys.					
. Water Discharges					
. Air Discharges					
. Land Discharges					
2. Regional Data Processing Equipment:					
. TSO Terminals:					
. LIS					
. OTHER SYSTEMS	-	7.0	-	-	7.0
. RJE Printers					
. Mini-Computer					
3. Personnel:					
. LIS					
. OTHER SYSTEMS					
4. Communication:					
. TSO					
. LIS					
. OTHER SYSTEMS	-	1.0	1.5	1.5	-
. RJE					
5. Central Computing - DCC:	-	4.0	7.0	8.0	-
6. OTHER COSTS					

EXHIBIT 4.

Region: Central

REGIONAL DATA PROCESSING STRATEGY
COST ESTIMATES - DECEMBER, 1980

Interface Element	Estimated Annual Cost in $1,000s.				
	1980/81	1981/82	1982/83	1983/84	Tota
1. Systems Software Connections:					
. Laboratory Information System (LIS)					
. Sample Information System (SIS)					
. Air Quality Information System (AQUIS)					
. Utility Performance Monitoring System					
. Industrial Liquid Waste Waybill System					
. Waste Site Information System					
. Industrial Performance Monitoring Sys.					
. Water Discharges					
. Air Discharges					
. Land Discharges					
2. Regional Data Processing Equipment:					
. TSO Terminals:					
. LIS					
. OTHER SYSTEMS	-	7.0	-	-	7.0
. RJE Printers					
. Mini-Computer					
3. Personnel:					
. LIS					
. OTHER SYSTEMS					
4. Communication:					
. TSO					
. LIS					
. OTHER SYSTEMS	-	0.6	0.6	0.6	-
. RJE					
5. Central Computing - DCC:	-	5.0	10.0	12.0	-
6. OTHER COSTS					

EXHIBIT 5.

Region: Southeastern

REGIONAL DATA PROCESSING STRATEGY
COST ESTIMATES - DECEMBER, 1980

Interface Element	Estimated Annual Cost in $1,000s.				
	1980/81	1981/82	1982/83	1983/84	Total
1. Systems Software Connections:					
. Laboratory Information System (LIS)					
. Sample Information System (SIS)					
. Air Quality Information System (AQUIS)					
. Utility Performance Monitoring System					
. Industrial Liquid Waste Waybill System					
. Waste Site Information System					
. Industrial Performance Monitoring Sys.					
. Water Discharges					
. Air Discharges					
. Land Discharges					
2. Regional Data Processing Equipment:					
. TSO Terminals:					
. LIS		20.0	-	-	20.0
. OTHER SYSTEMS		7.0	-	-	7.0
. RJE Printers		15.0	-	-	15.0
. Mini-Computer					
		42.0	-	-	42.0
3. Personnel:					
. LIS					
. OTHER SYSTEMS					
4. Communication:					
. TSO					
. LIS		1.8	1.8	1.8	-
. OTHER SYSTEMS		1.2	1.5	1.8	-
. RJE		4.4	4.4	4.4	-
		7.4	7.7	8.0	-
5. Central Computing - DCC:		10.0	12.0	15.0	-
6. OTHER COSTS					

EXHIBIT 6.

Region: Northeastern

REGIONAL DATA PROCESSING STRATEGY
COST ESTIMATES - DECEMBER, 1980

Interface Element	Estimated Annual Cost in $1,000s.				
	1980/81	1981/82	1982/83	1983/84	Total
1. Systems Software Connections:					
. Laboratory Information System (LIS)					
. Sample Information System (SIS)					
. Air Quality Information System (AQUIS)					
. Utility Performance Monitoring System					
. Industrial Liquid Waste Waybill System					
. Waste Site Information System					
. Industrial Performance Monitoring Sys.					
. Water Discharges					
. Air Discharges					
. Land Discharges					
2. Regional Data Processing Equipment:					
. TSO Terminals:					
. LIS					
. OTHER SYSTEMS		7.0	-	-	7.0
. RJE Printers					
. Mini-Computer		75.0	-	-	75.0
		82.0	-	-	82.0
3. Personnel:					
. LIS					
. OTHER SYSTEMS		17.0	18.0	19.0	-
4. Communication:					
. TSO					
. LIS					
. OTHER SYSTEMS		1.2	1.9	1.9	-
. RJE		5.0	6.0	7.0	-
		6.2	7.9	8.9	-
5. Central Computing - DCC:		8.0	9.0	10.0	-
6. OTHER COSTS		4.0	5.0	6.0	-

EXHIBIT 7.

Region: Northwestern

REGIONAL DATA PROCESSING STRATEGY
COST ESTIMATES - DECEMBER, 1980

Interface Element	Estimated Annual Cost in $1,000s.				
	1980/81	1981/82	1982/83	1983/84	Total
1. Systems Software Connections:					
. Laboratory Information System (LIS)					
. Sample Information System (SIS)					
. Air Quality Information System (AQUIS)					
. Utility Performance Monitoring System					
. Industrial Liquid Waste Waybill System					
. Waste Site Information System					
. Industrial Performance Monitoring Sys.					
. Water Discharges					
. Air Discharges					
. Land Discharges					
2. Regional Data Processing Equipment:					
. TSO Terminals:					
. LIS		20.0	-	-	20.0
. OTHER SYSTEMS					
. RJE Printers					
. Mini-Computer		75.0	-	-	75.0
		95.0	-	-	95.0
3. Personnel:					
. LIS					
. OTHER SYSTEMS		17.0	18.0	19.0	-
4. Communication:					
. TSO					
. LIS		3.0	3.0	3.0	-
. OTHER SYSTEMS		3.0	3.0	3.0	-
. RJE		3.0	6.0	7.0	
		9.0	12.0	13.0	-
5. Central Computing - DCC:		5.0	8.0	10.0	-
6. OTHER COSTS					

APPENDICES

1. LABORATORY INFORMATION SYSTEM (LIS)
2. SAMPLE INFORMATION SYSTEM (SIS)
3. AIR QUALITY INFORMATION SYSTEM (AQUIS)
4. UTILITY PERFORMANCE MONITORING SYSTEM (UPMS)
5. WASTE SITE INFORMATION SYSTEM
6. INDUSTRIAL LIQUID WASTE WAYBILL SYSTEM
7. INDUSTRIAL PERFORMANCE MONITORING SYSTEM (IPMS)
8. MINI-COMPUTER CATEGORY 1 APPLICATIONS
9. COMMUNICATIONS COSTS
10. ROLE OF SYSTEMS REVIEW BOARD (SRB)

APPENDIX 1.

LABORATORY INFORMATION SYSTEM

Background:

In 1978/79 a Feasibility Study was conducted and a report prepared recommending that the Ministry proceed with the development of an automated Laboratory Information System (LIS). This recommendation was subsequently reviewed and approved by the Ministry's Systems Review Board. A Request For Proposal (RFP) was then prepared and distributed to a number of potential suppliers. The successful supplier was Digital Methods Ltd. (DML) of Ottawa who proposed development of the system using Hewlett-Packard HP 3000 Series III computer equipment. This equipment was purchased by the Ministry in March 1979.

From April 1979 until November 1980, DML has been involved in the design and development of the system's application software. During this period both Ministry Laboratory and Laboratory user personnel provided DML with the information on which the system design is based. Final system acceptance testing was conducted in August 1980 and the system passed to the Ministry for implementation.

Description:

The LIS processes sample submission data when submissions are received at the Laboratory and test result data as it becomes available from analysis workstations located throughout the Laboratory. Upon completion of sample analysis the system matches the test results back to the original submission and produces both an analytical report for the client and sample results records for subsequent input to the Sample Information System.

The analysis functions performed by the system are:

- Submission Entry: When samples are received at the Laboratory the information from the accompanying submission and request for analysis sheets is entered into the system. Using this data the system:
  - creates internal submission and sample records
  - routes the requests for analysis (tests) to the appropriate workstations where the sample number is placed in the workstation queue.

- Workstation Control: Using a terminal located in his own Laboratory area a Scientist or Technician requests a display of the samples presently in the queue at a given workstation. From the queue he selects the samples he wishes to analyse during the current analytical run and requests that the system print a bench sheet. At this time the system will also remove the selected samples from the queue and identify them as belonging to a particular run.

- Run Processing: After analysing the samples in a run the Scientist or Technician will enter the test results into the system. Depending on the type of workstation the Scientist or Technician will then proceed directly to run approval or request that the system; calculate the calibration co-efficients (if needed); calculate the final test results.

  During run approval the Scientist or Technician has the option of ordering re-runs on particular samples. If he does so the system will re-insert the sample numbers back in the workstation queue where they will be available for subsequent analysis runs. When results are approved the system finds and inserts them in the records created from the original submission documents.

- Submission Approval: Using a terminal a Scientist with approval-authority requests that the system display the submission and sample records with test results ready for approval. Using this display the Scientist can either approve the results or, as in run-approved, order re-runs on particular tests. When a submission is approved the system will flag the corresponding records and place them in the analysis report queue.

- Submission Reporting: Once per day the records in the analysis report queue will be used to produce "Reports of Analysis" for the Laboratory clients. At the same time sample result records will be written on a computer tape for subsequent input to the SIS.

In addition to the analysis functions the system design includes the following two support functions:

- Query: Using any terminal in the Laboratory a Scientist or Technician can request that the system provide screen displays showing the analytical status of any submission, sample or test currently being processed.

- Support Files - using a terminal the system operator can make additions, changes or deletions to any one of the twenty-four support files maintained by the system.

Data Flow:

There are two LIS data flows depending on whether the sample analysis is to be carried out in the Toronto Laboratory or in one of the Ministry's Regional Laboratories.

With respect to the Toronto Laboratory the data flow is:

(1) While taking samples in the field the sampler records the pertinent information on the Laboratory submission and request for analysis sheets. He then submits the sheets to the Laboratory along with the samples.

(2) Upon receipt of the samples internal Laboratory sample numbers are assigned and recorded on both the sample containers and corresponding request for analysis sheets.

(3) While the sample containers are being distributed to the appropriate areas of the Laboratory the data recorded on both submission sheets are entered into the LIS.

(4) When processing is complete (i.e. all test results, or certain classes of results in a submission, are available) the system produces:

. a separate copy of the "Report of Analysis" for each client identified on the input submission sheet.

. sample result records suitable for input to the SIS.

(5) The "Report of Analysis" copies are mailed to the appropriate clients and the sample results records sent to the Downsview Computer Centre for SIS processing.

With respect to the Regional Laboratories steps (1) and (2) above are also followed. However, after assignment of Laboratory sample numbers the data flow procedures change as follows:

- A result of analysis sheet is initiated for the submission by recording the submission number, field and Laboratory sample numbers and the names of the tests requested.

- As tests are carried out Laboratory staff record the results on the result of analysis sheet.

- When all results for a submission are available a number of copies of both input sheets and the result of analysis sheet are made. One group of sheets is sent to the Toronto Laboratory and the others sent to the clients identified on the input submission sheet. The original sheets are retained on file in the Regional Laboratory. The system uses this information to produce sample results records and to update Laboratory production and sampling program workload statistics.

- Finally, the sample result records are sent to the Downsview Computer Centre for SIS processing.

During the initial development phase of the LIS Regional Laboratories were responsible for approximately 30% of the total test results produced by the Ministry. Because this was such a substantial amount it was apparent that system access would eventually be expended to include Regional Laboratories.

The first step in this expansion has already taken place by including Regional requirements as an intregal part of the systems' software design. To complete the process will require a number of additional steps such as equipment acquisition, staff training and file creation. Following are broad estimates of what is required in each of these areas:

Equipment Acquisition:

The equipment configuration in each Laboratory would include two terminals with built-in printers plus a 300 LPM line printer. Estimated cost of such equipment is:

- 6 Terminals @$4,500 each = $27,000
- 3 Line Printers @ $11,000 each = $33,000
- 3 Line Printer Controllers @ $ each =
- 6 Terminal Modems @ $300 each = $ 1,800

Staff Training and File Creation:

Systems Development Staff would require approximately 2 weeks in each Region to initiate the staff training program and to assist in file creation.

Estimated Cost:

120 man-days @ $155/day = $18,600

Not included is the assistance required from Toronto Laboratory Staff in both of these tasks.

APPENDIX 2.

SAMPLE INFORMATION SYSTEM

Background

In 1970-72 the Ontario Ministry of the Environment (then the Ontario Water Resources Commission) developed and implemented the "Water Quality Information System" to store and retrieve data for the Great Lakes program.

Since its implemention, the system has been substantially modified to expand the retrieval capabilities and to enable the storage of all sampling data analysised at the Ministry's laboratories. The system is now referred to as the Sample Information System (SIS).

Currently, the Water Resources Branch is the major user of the system with 4 studies: Great Lakes; Limnology and Toxicity (Sudbury Environmental Study and the Lakeshore Capacity Study); Observation well Levels; and River Basins. The South East Region uses the system to store their Recreational Lake data. The following table shows the number of records stored in the system to date.

Study	Years	No. of Records
Great Lakes	67-80	169,169
Limnology and Toxicity	73-80	18,455
Observation Well Levels	74-78	84,031
River Basins	64-80	85,790
Recreational Lakes	77-79	11,409

Objectives

The Sample Information System (SIS) is a generalized automated storage and retrieval system designed to edit, store and retrieve sample submission/results data processed in the laboratories of the Ontario Ministry of the Environment. It also provides the capability for including sample submission results data from other agencies upon reformatting to meet the systems requirements.

The overall objectives of the Sample Information System are:

(i) to provide a standard sample results master file format for storage of Ministry sample results data

(ii) to provide a standard input and master file format for storage of sample point locations and descriptions

(iii) to provide a standard method of "range editing" for sample results data by geographical location

(iv) to provide a common data retrieval method to meet the requirements of the Ministry's branches

(v) to be capable of expansion or modification to include additional and future sampling programs

(vi) to provide an interface between the Laboratory Information System (LIS) and the storage and retrieval needs of the Ministry's operating branches.

SYSTEM DESCRIPTION

The Sample Information System is made up of five phases:

1. Data generation
2. Data recording
3. Data validation
4. Data storage and retrieval
5. Data analysis and interpretation

These phases of data processing as they apply to air and water quality surveillance, are discussed in the paragraphs that follow.

Data Generation

Generating raw data (i.e., unprocessed and unvalidated observations representating levels of pollutants or related information) is the first step of acquiring air and water quality data. In the past control agencies have given this phase the major share of attention. Such considerations as sampling method, averaging time, instrument type, and site location have been extensively reviewed. Identification and characterization of the sampling site, however, have sometimes been neglected. Yet data cannot be properly interpreted unless the conditions under which they were gathered are know. All to frequently, detailed information on sampling sites, instruments, and methods are unavailable. These omissions seriously reduce the usefulness of the data. Agencies should take great care to provide a complete and extensive description of the sites (and their surroundings) at which data are gathered, and to provide complete and accurate location data along with descriptions of the sampling methods and analytical procedures. This information about the sampling sites will help assure that data gathered at those sites are not misinterpreted or misunderstood.

Data Recording

With certain instrumentation, data representing pollutant concentrations, time of occurance, and other related information are recorded at the sampling location. These data may be in machine-readable or non-machine-readable form or both (e.g. pollutant observations on punched papertape with the information describing instrument maintenance hand-recorded). With other devices such as manual samples (machine or man) the only data recorded at the site are identification, field observations and if required, maintenance information. The collected samples are chemically analyzed and observations recorded at a central location.

Regardless of how the data arrives for processing, at this point the question of format arises. Choice of a format need not present difficulties, however, if one realizes that it simply involves selecting a systematic way of recording data for processing. Selection of a format need not constrain an agency in any way, particulary if data are recorded in machine-readable form, for then the data can be reproduced with very

little difficulty into a variety of forms and formats. For example, an agency could easily use one format for certain internal records and another format for interchange of data with other agencies.

The availability of data in a clearly defined and well-documented format is the very basis of an effective data processing system. All too often, data are recorded in a format that is complicated, confused, incomplete, and insufficiently documented. When such data leave the immediate care of the person responsible for recording them, their utility is effectively lost. The SIS format provides a complete, systematic method for recording data for storage or reporting purposes. Because a complete description of this format is available to all users, data recorded in this format are immediately accessible and exchange of data among agencies is facilitated. Thus, the SIS system format is used to record all sample submission data submitted to the Ministries laboratories.

Data Validation

An agency's routine use of an effective data evaluation process determines the validity and usefulness of the numbers recorded. The first major step of input validation is applying corrections for known instances of instrument malfunction.

The second major step in data validation is investigation of other possibly incorrect data. The data under scrutiny should be carefully compared with a previously established table of limits for:

1. High values.
2. Low values.
3. Extreme changes in values for consecutive observations.

Limits for high values could be based on air or water quality standards or on past history of the sampling site. Limits for low values could represent the minimum detectable capability of the instruments and methods of analysis. A low-value check could also be made for consecutive readings below a designated value. Where past data from the site are available, the current values can also be compared with earlier trends as a validation check.

Data Storage and Retrieval

Systematic data storage provides a means of protecting records against physical deterioration and also insures that past data can be quickly and easily retrieved. Effective security measures must be determined to guard against premature release of data before they have been throughly validated. Data retrieval involves procedures whereby past data can be readily located, retrieved, and used. Careful and complete documentation of the location and content of stored records will insure that established procedures are followed and records are used properly.

Data Analysis and Interpretation

Data analysis usually includes calculating arithmetic and geometric means and their respective standard deviations. The means provide a useful measure of central tendency or the "average" value of a pollutant

concentration, while the standard deviations and maximum pollutant concentration are useful for characterizing the spread of the data values about the mean value. Many agencies also calculate frequency distributions, which give the percentage of sampling intervals during which any given pollutant concentration is exceeded. Agencies also may perform more elaborate analyses for research studies or other special uses. Upon completion of data analysis, an effort should be made to interpret the results in terms of meteorological conditions, characteristics of emission sources, and topographic conditions. Data interpretation requires complete and detailed knowledge of the sampling site and surrounding area, as well as the instruments and sampling methods. Here again is reflected the importance of the site identification data, which can pinpoint the location of unusual occurrences that may call for even more detailed information about the area. In this way agency personnel can develop an understanding of the characteristics of air quality within their jurisdiction. This understanding is then applied in working with local industries and citizens towards effective prevention, control, and abatement of air pollution.

MINISTRY DATA COLLECTION AND STORAGE PROCESS

This section briefly describes the process of data collection for routine monitoring programs within the Ontario Ministry of the Environment. The block diagram of Figure 20-1 illustrates the steps involved.

The location of a sampling point is decided, based on criteria such as (i) type of program, (ii) topography of the region, (iii) use of water (water quality programs), (iv) discharge (into air-water), (v) planned or potential industrial, municipal or agricultural development.

Once the station location is chosen, a station number (maximum of 20 characters - see Station Description File) is assigned and the information on the station description file update form is filled in. If required, limits for the tests to be analyzed at a location are coded on the station supplementary file form. The forms are then sent to the Systems Operations and Support Section of the Financial and Administrative Services Branch for keypuching and subsequent storage on the appropriate data files. The information about the sampling point needs to be filled out, keypunched and stored only once per sampling point, prior to storing actual analytical results. If at a later date it is found that some of the fields for a particular station number need modification, the system allows such transactions.

The sample is collected and certain field measurements are done, depending on the specific program for which the sample is taken. The field information, such as date, time, depth of sampling, field sample number, and field results are recorded directly onto the Laboratory Field Sheet.

The sample, in the proper container (if required) with the proper information, is sent or taken to one of the regional laboratories or to the main laboratory in Toronto for analysis.

When the sample has been analyzed, the laboratory sends an analysis report to the appropriate person (s). Usually weekly, a computer tape is produced at the main laboratory with all the field data and analysis at this point. This tape is then used to update the SIS sample results master file. There are two types of records on this file (i) interim, and (ii) final.

An interim records has the same format as a final record except that all the analysis for a sample have not been completed at the time of data transfer to the SIS. The following week this same interim record could be transferred as a final record if all the analysis are then completed.

Once the data tape is received at the computer centre, the update of the sample results file takes place. The update generates a listing for

(i) Interim records added or replaced
(ii) Final records added
(iii) Analysis results which were outside specified limits as defined by the user on the station supplementary file
(iv) control summary

Detailed error messages will be printed on the appropriate reports. Explanation of the messages produced are given in a subsequent chapter. When the update is completed, the reports are sent by the Systems Operation and Support Section to the manager of the program.

Immediately after the update the data are ready for retrievals.

SIS SYSTEM DATA FILES

The sample Information System contains four data files which are used to (i) identify and describe sampling locations, (ii) define edit ranges for tests at sampling locations, (iii) define coding structures used in the SIS system, (iv) store the analysis and field data. A description on each file is given below.

Code Description File (CDF)

This file presently contains codes and descriptions for:

- ministry region - district
- ministry sampling progams
- SIS sample types
- unit of measure
- remarks (for analysis tests)
- test name category
- test names
- external systems
- hydrologic code (STORET)
- Water Quality Compliance - Water Uses

The updating of this file is controlled by Systems Development and Laboratory staff. Where warranted, further explanations are given on the above codes.

Test Name Code

The test name code of six alphanumeric characters is intended to be used as a short form unique identifier allowing field personnel to specify easily yet precisely the tests they wish performed on their particular sample or data they wish retrieved. In many instances the code also carries information on sample fractionation and treatment prior to analysis, as an aid to the field personnel in selecting analyses.

Systematic coding of all types of chemical and microbiological analyses using the same format within the six available code characters is not possible without reducing the basis of systematization to trivialities. Thus, the analytical procedures are broken into eight major categories:

a Inorganic elements and compounds
b) General chemistry including organic carbon
c) Physical tests
d) Specific organics and Pesticides
e) Microbiological tests
f) AMES tests
g) Field data tests
h) Station location fixed parameters

Each of these categories utilizes the six characters of the code in the manner most meaningful to the application.

The systematization of this code is intended to allow someone who doesn't know the code to make a good guess at it, in order to gain entry to the data retrieval systems with a reasonable hope of finding the correct code quickly. Although the code can be directly decoded in most cases, some knowledge of the analytical procedures involved may be required to identify and make sense of the exceptions. Referral to the full test description may be necessary in ambiguous cases.

The basic rules for encoding an analysis or procedure are as follows:

i) Elements are coded as their chemical symbols in the first two characters. Single letter symbols are placed in the first character with the second character blank.

Single exception: TC = Total Coliform (not Technetium)

ii) Compounds or ions are coded with the principal element in the first two positions (as in a) and suitable modifiers in characters three to six.

iii) Analyses which cannot be coded by placing an element symbol in the first two characters may use any combination of characters which do not constitute a valid element symbol.

iv) The following modifiers indicate the fraction of sample upon which the procedure is performed.

A - ash
F - filtrate
H - head gases
P - particulate
X - extract
U - unfractionated/unfiltered

The following modifiers indicate the severity of the subsequent analytical treatment prior to introduction to the measurement system:

R - reactive
T - total

Other reserved letters may be added to the above two lists as the need arises.

v) The severity of treatment modifier is always preceded by a fraction of sample modiefier, and is always the last character in the code.

vi) The fraction of sample code will be the last or next to last character in the code, depending on the absence or presence of a severity of treatment character.

For microbiological tests the first 2 characters of the test name code represents the group of organisms which are being examined (e.g. FC for Fecal Coliform) or a general heading which relates a group of tests (e.g. MT for microbial taxonomy tests). The character combination must not be identical to any other character combination defined for other microbiological tests or test codes in other categories. The last 4 characters of the test name code are used to identify the portion of the group of organisms (e.g YE CA -- for yeast - candida albicans) or of tests (e.g. MT ØXID for oxidase microbial taxonomic test). Also included in these 4 characters is any major method variation which will reflect on the reported results (eg. MF, MPA, or PA). Where a genus has been defined in the first 2 characters the species may be defined in the last 4 characters.

The pesticides and herbicides (and such other industrial organics as appear in the analytical scans with them) are divided into classes arbitrarily coded using a letter as the first character and a number as the second character. The particular compound is further identified by a mnemonic, acronym, or other set of characters derived from the name of the compound in character positions three to six. Sample fraction and severity of reaction are not coded as part of the test name code.

Unit of Measure Code

The "unit of measure" is a list of 1000 definitions coded from 000 to 999. The first part of this list defines a characteristic to be know as "dimensions". The latter part of the list defines a characteristic to be know as "scale". Associated with any lab result or field observation or other calculated numeric will be a "unit of measure code" consisting of 6 characters. The first three define "dimension" and the second three define "scale" (e.g. Sulphate - dimension = mg/L, scale = as SØ4).

Ministry Sampling Program Code

All samples taken for the Ministry are assigned to a specific program. The Program code is used to identify the area of study for which the sample was taken.

The program code consists of nine characters. The first two characters of the code represent a broad area of interest and are referred to as the program (e.g. Air Assessment and Abatement). The third thru fifth characters are used to define a study within a specific program. For example, the Air Quality Routine Monitoring study within the Air Assessment and Abatement program. The sixth and seventh characters are used to identify a project within study and the eighth and nineth characters to define a sub-project within project.

An example of nine character Program code follows:

Program	02	Air Assessment & Abatement
Study	001	Air Quality Routine Monitoring
Project	01	HIVOL Project
Sub-Project	07	Lead Survey

Station Description File (SDF)

This file contains information about the sampling points or stations located throughout the Province of Ontario. Each record on the file contains a verbal description of a sampling point plus various codes designating its geographical location (e.g. latitude and longitude, ministry region/district, country/district, hydrologic codes, etc.)

The SDF file is a sequential file stored on magnetic tape. The stations are placed in the file in ascending sequence by station ID number within program-study code.

Station Supplementary File (SSF)

This file contains reasonability and water (air) quality exceedence result ranges by tests within a program-study.

The resonability ranges are used to validate sample result values before the Sample Results Master File is updated.

The exceedence ranges are used to produce a report showing the percent of samples which exceeded provincial standards for tests tested at specific stations for a given set of water uses (water quality program).

Sample Results Master File (SRM)

This file contains sample submission and analytical results data. Each record on the file contains descriptive information on a sample (e.g. locations, sampling data and time, depth of sample, type of sample etc.) plus the analytical results of any physical, chemical or bacteriological tests performed on the sample. For each record, at least one test code and value must be present.

There will be one magnetic type file for each program-study. This file is organized sequentially by station id number. Within each station id number the samples are stored in chronological order by the date of sampling, sample type and sample number.

RETRIEVAL OF DATA FROM S.I.S.

The system has been set up to permit Ministry personnel the capability to retrieve data in a flexable manner using a data terminal connected to the Downsview Computing Centre. The block diagram of Figure 20-2 illustrates the steps involved.

To retrieve data, the user of the system would create a dataset (under TSO) containing the control information which would specify the selection criteria and processing options required. The format of this control file is described in the chapter : DATA RETRIEVAL. Once the dataset has been created, the user has the option to execute a TSO procedure to edit the dataset for syntax errors. Another procedure would be executed to submit the retrieval request for background processing.

To restrict the use of the system to authorized persons, each user must have an unique TSO USERID. This may be obtained by contacting the Systems Operations and Support Section. Once this userid has been assigned, a letter of authorization signed by the branch or regional Director would be forwarded to the Systems Development Section. Systems staff would then define the userid to the SIS system which would then allow the user to access the system.

The following describes the systems output reports. Examples of the reports and output file are located at the end of this chapter.

Station Detail Report

The report consists of a detailed listing of sample data for 1 to 10 tests at a given station within a given period of time per printed line. Up to 200 tests may be displayed. The order of the tests on a page is established by the sequence that the user codes them in the control data file.

When more than ten tests are retrieved for a series of stations, the system will print the data from the first ten tests for the first station, then the second group of ten tests for the first station etc., followed by the data for the second station.

Parameter Summary Report
In the Parameter Summary, data is arranged in sections by parameters. There is no limit to the number of sections (parameters). Thus with this report, it is possible to make a request for all parameters. Within a section, data is arranged station by station. A section may encompass any number of stations. A single line presents the maximum, average and minimum values of a parameter at a station for the time period and depth range specified on the request. Successive lines present summaries at successive stations.

Selected Station Description Report
This report lists supplementary characteristics of the stations for which parameter data has been retrieved.

Selected Parameter Description Report
This report lists supplementary characteristics of the parameters for which data has been retrieved.

Water Quality Criteria Station Summary Report
This report program compares sample results data to criteria levels stored on the Station Supplementary File or levels specified on the general retrieval Form A and produces a series of tabular reports by station. Each table lists the percentage of sample results for each parameter requested which exceeds a criteria level for up to 8 water uses. Also listed is the average exceedence.

The report has the format of one station per page with all specified water use codes printed across the page (maximum of 8) and all requested parameters listed from top to bottom down the page in sequence by parameter code.

Water Quality Criteria Parameter Summary (Figure 35)
This report is produced by a program reading in a file created by the Water Quality Criteria Exceedence Report program. The report consists of four graphs per page. Each graph expresses the percentage of stations in a given period of time (maximum of 4 seasonal date ranges) that fall within a pre-determined percentile range for a requested parameter - water use combination.

Water Quality Criteria Station Exceedence Report (Figure 36)
This report would list the stations falling within each percentile range for a specified water use - parameter combination.

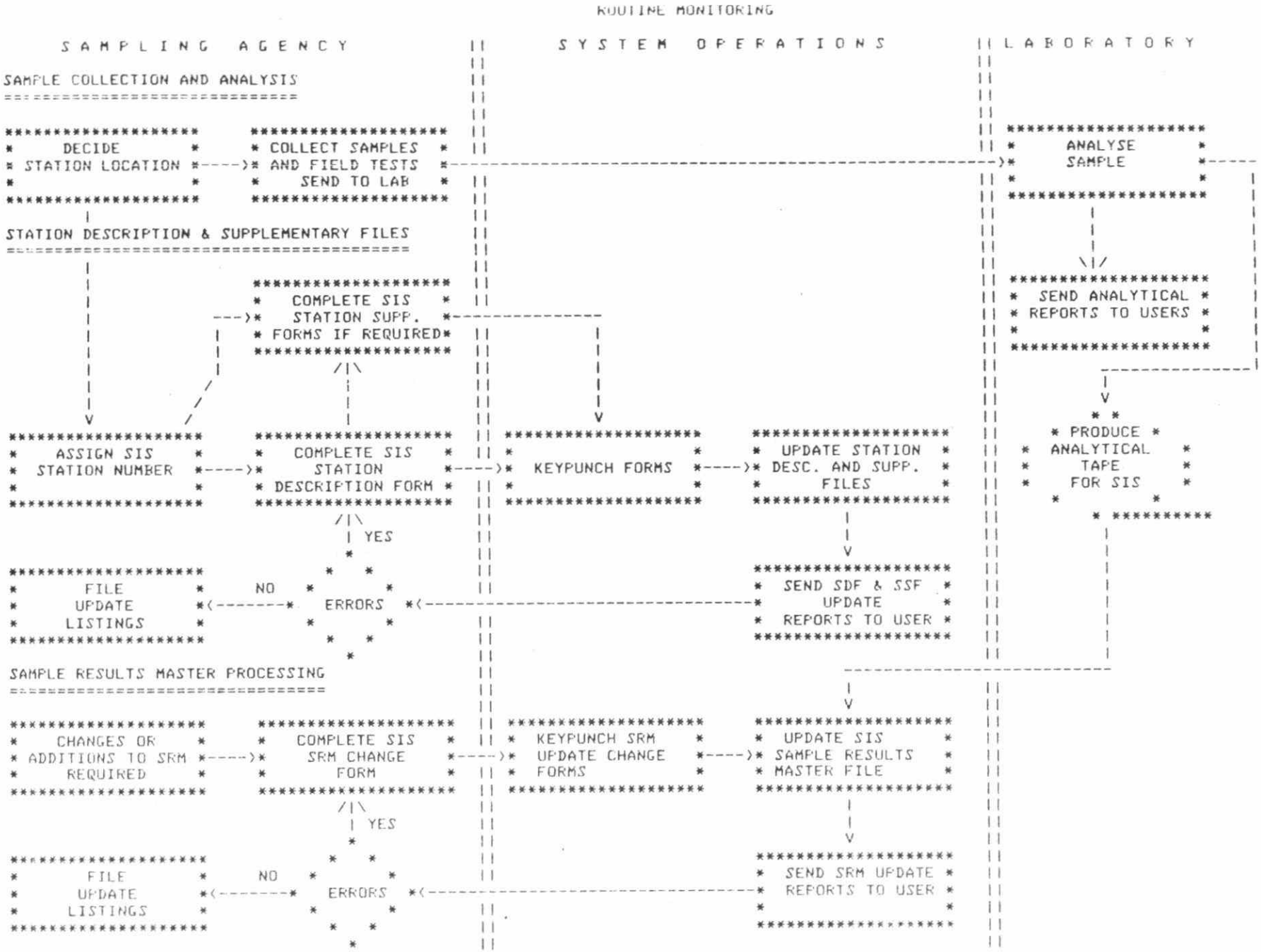
The following files when requested are written onto tape, with a retention period of 90 days. It is the responsibility of the user to increase the retention period if required.

(i) Selected Sample Results Master File
This file is created upon request during a retrieval run and contains sample results records selected from the SRM master file. Each record can contain up to 64 result answer areas. The format of this file is exactly the same as that of the master file (variable length records).

(ii) Selected Station Description File
This file contains a record for each station for which data was requested. The format of this file is exactly the same as that of the SDF master file.

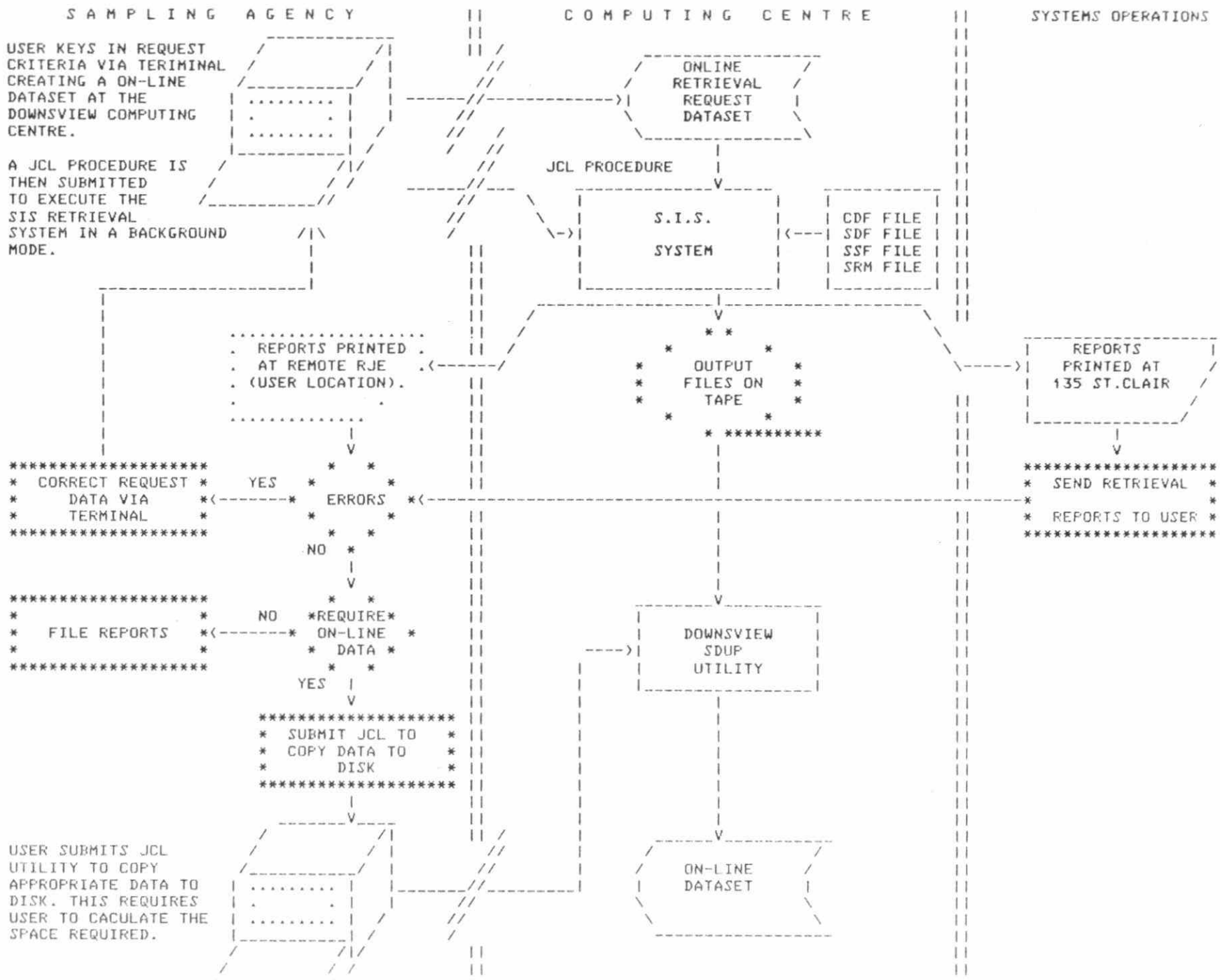
(iii) Selected Parameter Description File
This file contains a record for each parameter for which data was requested. The format of this file is exactly the same as that of the PDF master file.

(iv) SPSS File (Figure 45)
This file contains fixed length records as opposed to variable length records as in (i) above. Each record has 20 (maximum at present) result answer areas. The arrangement of the analysis results on each record is determined by the order and position in which the parameter codes have been coded on the retrieval request Form A. All unused areas are zero filled.


ROUTINE MONITORING
SAMPLING AGENCY
SYSTEM OPERATIONS
LABORATORY
SAMPLE COLLECTION AND ANALYSIS
DECIDE STATION LOCATION
COLLECT SAMPLES AND FIELD TESTS SEND TO LAB
ANALYSE SAMPLE
STATION DESCRIPTION & SUPPLEMENTARY FILES
COMPLETE SIS STATION SUPP. FORMS IF REQUIRED
ASSIGN SIS STATION NUMBER
COMPLETE SIS STATION DESCRIPTION FORM
KEYPUNCH FORMS
UPDATE STATION DESC. AND SUPP. FILES
SEND ANALYTICAL REPORTS TO USERS
PRODUCE ANALYTICAL TAPE FOR SIS
FILE UPDATE LISTINGS
NO
ERRORS
YES
SEND SDF & SSF UPDATE REPORTS TO USER
SAMPLE RESULTS MASTER PROCESSING
CHANGES OR ADDITIONS TO SRM REQUIRED
COMPLETE SIS SRM CHANGE FORM
KEYPUNCH SRM UPDATE CHANGE FORMS
UPDATE SIS SAMPLE RESULTS MASTER FILE
FILE UPDATE LISTINGS
NO
ERRORS
YES
SEND SRM UPDATE REPORTS TO USER

SAMPLE INFORMATION SYSTEM

DATA RETRIEVAL - BLOCK DIAGRAM


SAMPLING AGENCY
COMPUTING CENTRE
SYSTEMS OPERATIONS
USER KEYS IN REQUEST CRITERIA VIA TERIMINAL CREATING A ON-LINE DATASET AT THE DOWNSVIEW COMPUTING CENTRE.
A JCL PROCEDURE IS THEN SUBMITTED TO EXECUTE THE SIS RETRIEVAL SYSTEM IN A BACKGROUND MODE.
ONLINE RETRIEVAL REQUEST DATASET
JCL PROCEDURE
S.I.S. SYSTEM
CDF FILE
SDF FILE
SSF FILE
SRM FILE
REPORTS PRINTED AT REMOTE RJE (USER LOCATION).
OUTPUT FILES ON TAPE
REPORTS PRINTED AT 135 ST.CLAIR
CORRECT REQUEST DATA VIA TERMINAL
YES
ERRORS
NO
SEND RETRIEVAL REPORTS TO USER
FILE REPORTS
NO
REQUIRE ON-LINE DATA
YES
DOWNSVIEW SDUP UTILITY
SUBMIT JCL TO COPY DATA TO DISK
USER SUBMITS JCL UTILITY TO COPY APPROPRIATE DATA TO DISK. THIS REQUIRES USER TO CACULATE THE SPACE REQUIRED.
ON-LINE DATASET

APPENDIX 3.

AIR QUALITY INFORMATION SYSTEM (AQUIS)

1.1 GENERAL DESCRIPTION:

The system is used primarily to process, store and analyse the concentrations of various air contaminants measured at locations scattered throughout the province of Ontario. A substantial portion of the air quality data and almost all the meteorological data are acquired on a real time basis through the operation of a telemetering system. Presently, the system process information on approximately 100 different contaminants including the meteorological measurements which are identified by a set of common codes. The system reports on the ambient air quality levels in the Province and assists the management in determining the compliance of the ambient air quality levels with the criteria levels for desirable air quality set under the Province's Environmental Protection Act, 1971.

The system also provides a province wide inventory of ambient air quality and meteorological measurements. These data are available to the universities, public and private agencies and to the general public on request.

1.2 DATA DESCRIPTION

Time period: 1952 to Present
Data on air contaminants - gaseous, particulate matter and dustfall
Meteorological data - Wind speed and direction, temperature and temperature gradients

1.2.1 DATA IDENTIFICATION

The data is uniquely identified by a set of station numbers and a set of common pollutant codes. Station numbers are related to their street addresses and UTM grid coordinates.

1.2.2 DATA RETRIEVAL

The air quality and meteorological data is retrievable by specifying the sampling location (station number) and the contaminant (pollutant code).

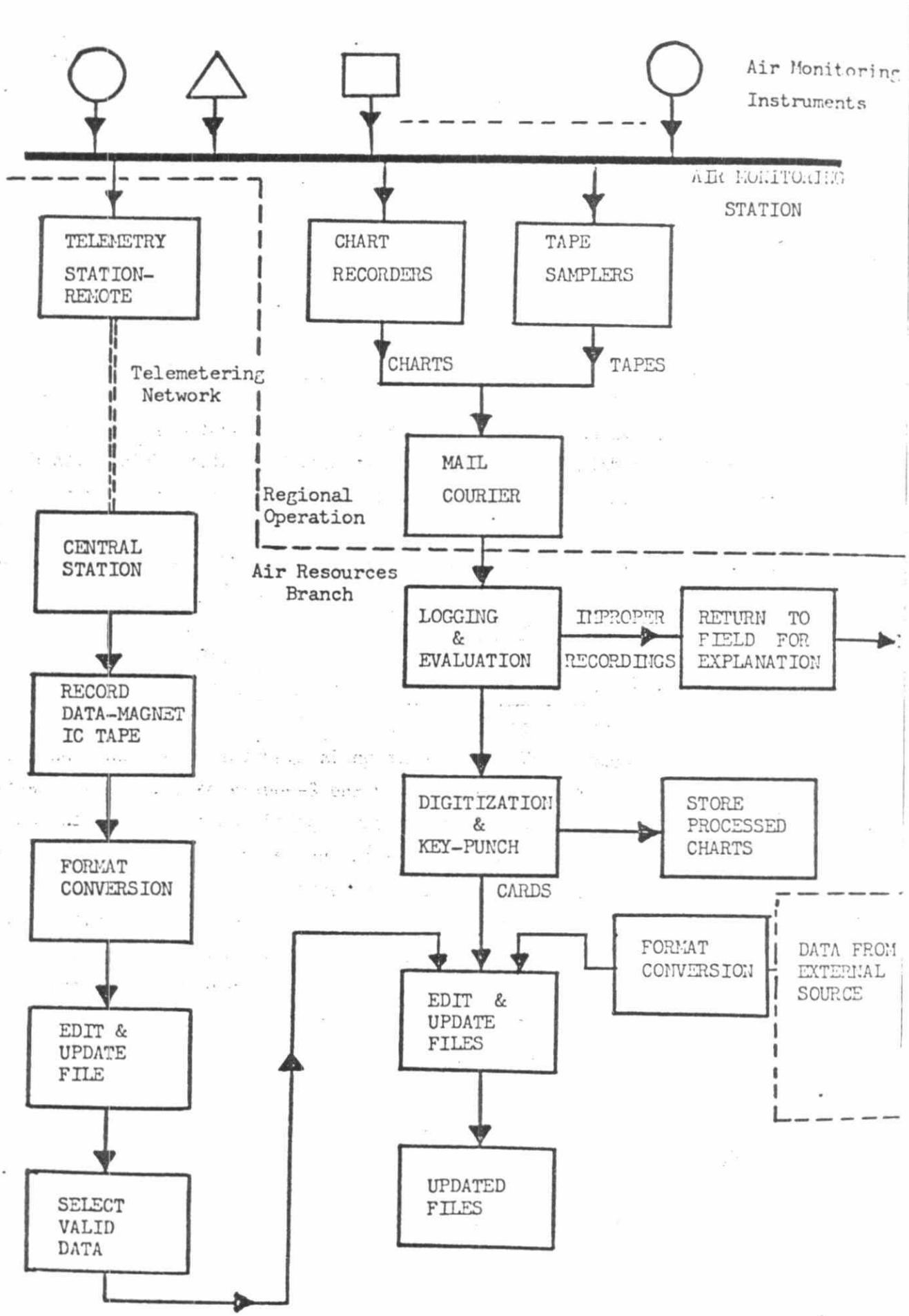
1.3 SYSTEM CONTROL

The updating and analysis of information in the air quality and meteorological system is centrally controlled through a system of master control files. These files contain both the data identification elements, i.e. station location data, pollutant codes, unit codes etc., as well as the control parameters and criteria levels which control the execution of edit, format conversion, data manipulation and report generation programs.

1.4 COMPONENT SUB-SYSTEMS

1.4.1 HOURLY SUB-SYSTEM

This sub-station is used to process and analyze data sampled on a hourly and 2-hourly basis. This data is obtained as the recordings of continuous monitoring instruments on strip charts and tapes. A substantial portion of this data is acquired on a realtime basis through the operation of a telemetering network. The telemetered data is recorded onto an IBM compatible magnetic tape. The only data in the 2-hourly category is the coefficient of haze, measurements on non-telemetered samplers.



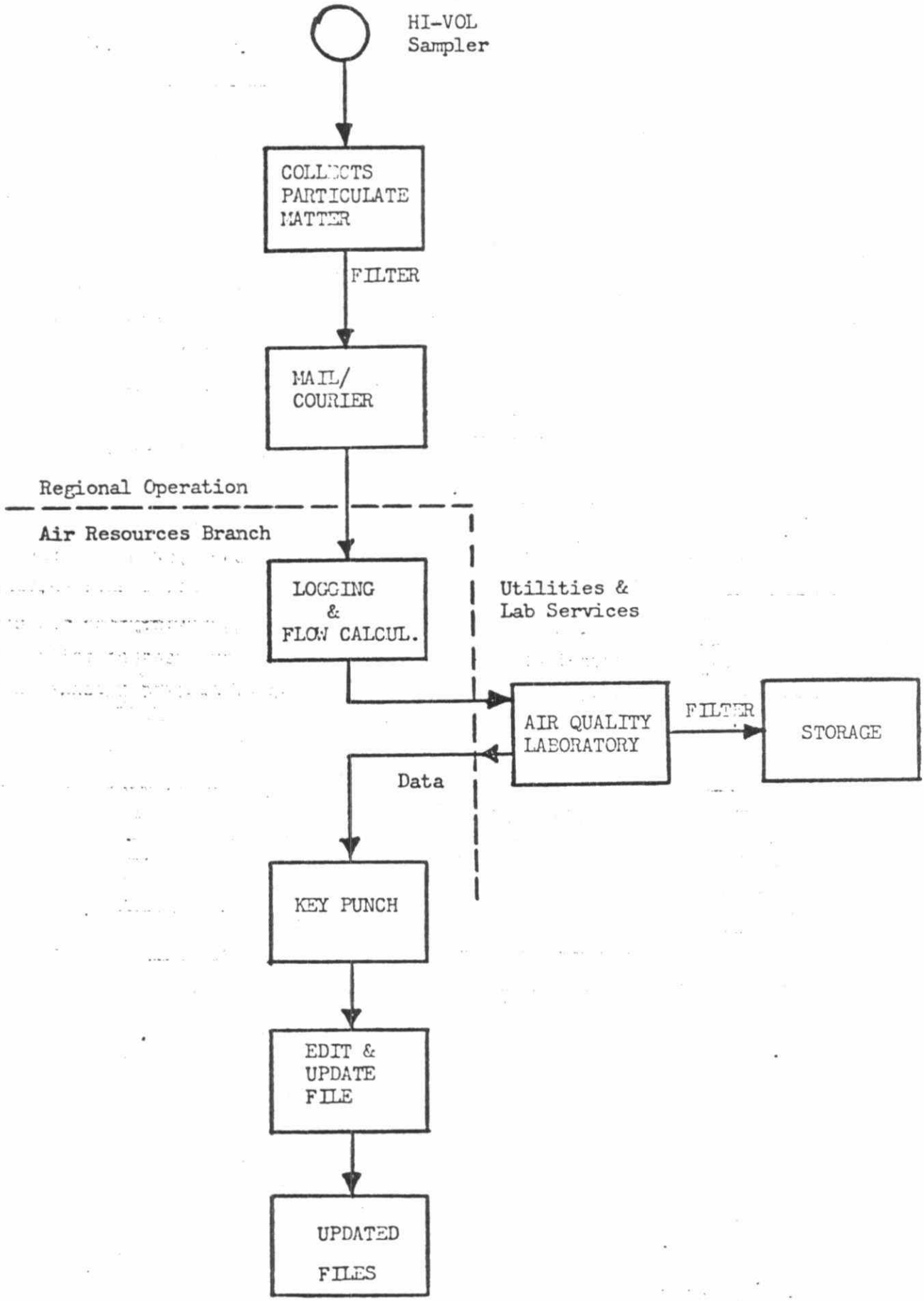
CONTINUOUS MONITOR DATA AQUISITION & PROCESSING

1.4.2 HI-VOL SUB-SYSTEM

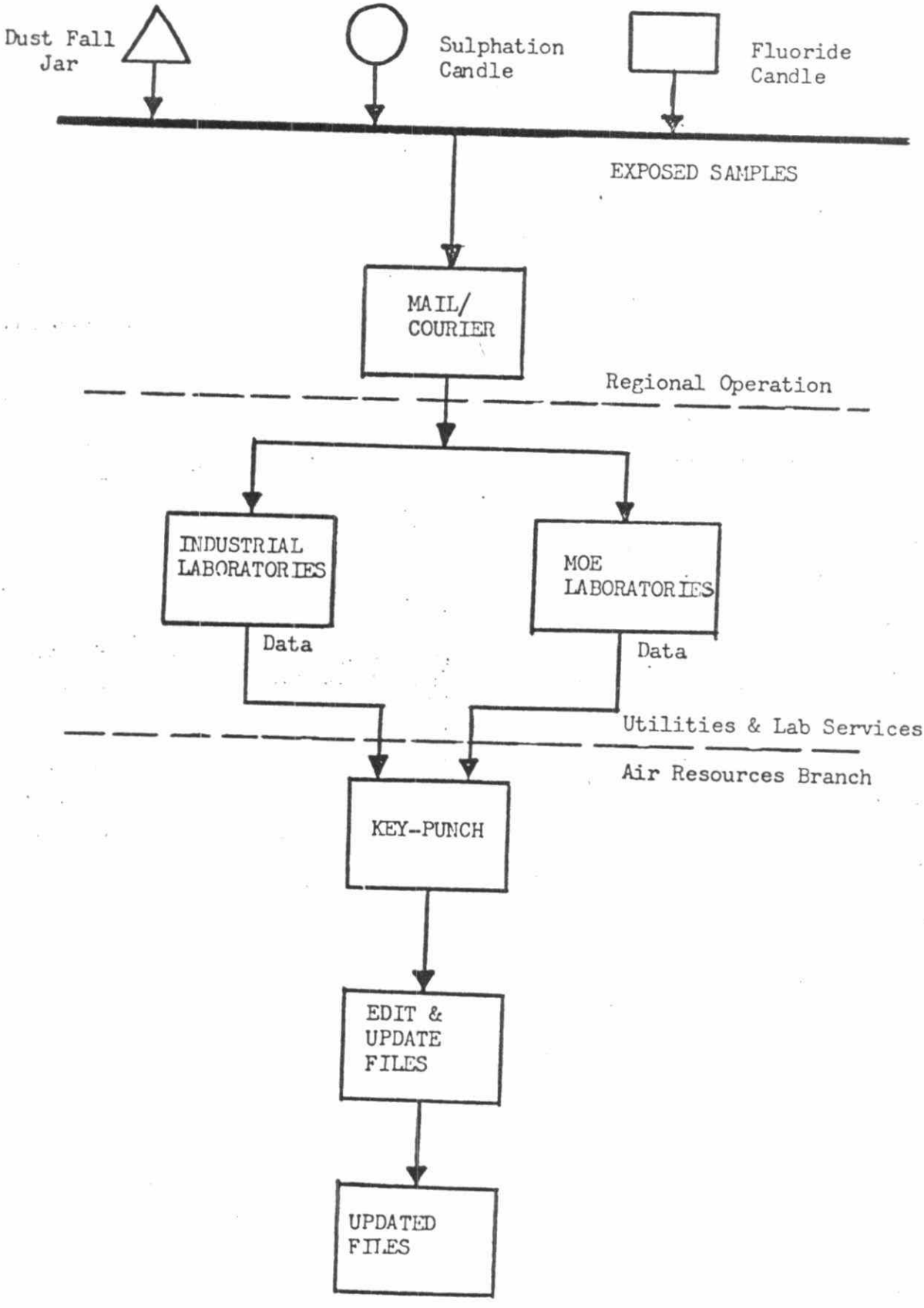
The data processed by this sub-system is obtained through the operation of "High Volume" (Hi-Vol) samplers. A Hi-Vol sampler is, in principle, similar to a vacuum cleaner that collects suspended particulate matters in a filter bag. The sampling period is 24 hours and the samplers are normally operated on a daily, bi-weekly or a weekly basis. The contents of the filter bags are analysed in the laboratory for suspended particulate matter and other metallic and non-metallic components.

1.4.3 MONTHLY DATA

The monthly data processing sub-system performs the processing and analysis of air quality data collected on a monthly, i.e. 30-day sampling, basis. The measurements techniques include the laboratory analyses of fallout in dustfall jars, and the analyses of exposed sulphation and fluoride candles, etc.



HI-VOL DATA COLLECTION & PROCESSING



MONTHLY DATA COLLECTION & PROCESSING

1.5 PROGRAM AND PROCEDURES

1.5.1 Programs

The system utilizes 55-60 COBOL and FORTRAN programs and sub-programs for the maintenance and analysis of air quality and meteorological data. The programs are classified as "maintenance" or "analysis" programs depending upon their application. The maintenance programs are designed to perform a general function and thus a single program of this type may be functional for a wide variety of data formats and applications. The analysis programs are often customized to meet a specific application requirements.

The program modules are maintained in disk resident libraries at the computing centre. A complete listing of programs in current use is available in the Appendix P.

1.5.2 Procedures

A procedure is a pre-arranged sequence of system commands. It is a convenient method for executing a sequence of JCL and/or TSO commands on a frequent basis. The two types of system procedures in use, JCL procedures and TSO command procedures, are catalogued in the system libraries. A brief description of current procedures is provided in the Appendix Q.

1.6 DATA FILES

The air quality and meteorological data is maintained in a set of data files. Both the air pollution as well as the meteorological measurements are identified by a set of common pollutant codes, i.e. wind speed/direction or temperature information may be processed and analyzed on the same basis and using the same programs as an air pollutant, e.g. sulphur dioxide. A detailed description is included in Appendix F.

1.6.1 Specifications

Organization:	Sequential
Storage Media:	Current - magnetic tapes 9 track, 6250 bpi
	Past - Offline disk pack 3330 type I
	Backup - magnetic tapes
Data Type:	Hourly, Hivol (single year files) Monthly (multi-year file)
Storage Location:	Downsview Computing Cnntre (Primary and backup) Provincial archives, Mississauga (Backup).

AIR QUALITY PROCESSING SYSTEM FILES

1.0 GENERAL DESCRIPTION

The air quality and meteorological data are stored in a set of data files. The data are uniquely identified by station numbers, pollutant and the date and time a particular measurement was carried out. Station numbers are related to their street addresses and UTM grid locations. This information is held in a descriptive file and this file controls the maintenance, updating and analysis of all files in this system. Both the air pollution as well as the meteorological measurements are identified by a system of common pollutant codes; i.e. wind speed/direction or temperature information may be accessed on the same basis and using the same maintenance/analysis programs as an air pollutant (e.g. SO_2). Although the system records the UTM grid co-ordinates of the sampling stations, the data is not accessible by grid locations.

The following files are currently maintained by the system:

1.1 CONTROL FILES

The control files hold descriptive details of stations, regions, pollutants and unit codes. They also contain parameters and control variables used by various programs in editing, data scaling, format conversion, data extraction, statistical analysis and report generation.

1.2 DATA FILES

1.2.1 Continuous Monitor Data

These files include one-hourly and 2-hourly sampled data from air pollution and meteorological sensors. The files are organized on a calendar year basis and are sorted by pollutant, station and date. The data is stored in a binary format. Each record contains a whole month's data for one station-pollutant combination.

1.2.2 Hi-Vol Data

This file holds data obtained through the operation of hi-vol samplers, i.e. data sampled on a 24-hour basis (one sample reading per day). The data recorded include suspended particulates and the laboratory analyses of suspended particulates for various metallic and non-metallic components.

1.2.3 Monthly Data

These files hold data recorded on a monthly, i.e. 30-day, sampling basis. These include data from dustfall jars, sulphation and fluoridation candles and the data obtained through the laboratory analyses (for heavy metals) of dustfall. This data is stored as 80-column card images. This is a multi-year file and each record holds one year's data for one station-pollutant combination.

A detailed description of the data set names and format specifications are provided in the following sections.

APPENDIX 4.

UTILITY PERFORMANCE MONITORING SYSTEM

Background

The input portion of the system has been tested out and implemented. Data for 1978 and 1979 is currently being entered and processed for editing and correction purposes.

The development of the basic reporting system, for both imperial and metric units, is nearing completion.
In 1980/81 the system will be expanded to include municipal-operated plants in addition to Ministry-operated plants and performance criteria for planning purposes.

System Description

The Utility Water Pollution Monitoring System (UWPMS) maintains identification, location and descriptive data on water and sewage treatment plants and various control points within plants where monitoring information is required. It also processes and maintains data files of daily, weekly and monthly quantities and concentrations of various parameters measured and sampled at plant control points.

The system combines the above data and produces the following types of reports:

- Loadings in and out of Water and Sewage Treatment Plants in order to facilitate operational control.

- Loadings being discharged to receiving waters in order to assist in appraising the effects on water quality and the effectiveness of the treatment facility.

The system consists of the following files:

1 - Utility Descriptor File
  - containing descriptive data on a plant such as name, location, watercourse, etc.

2 - Control point descriptor
  - containing descriptive data on each control point where the plant is required to submit data

3 - Monitoring summary master
  - containing descriptive data of each parameter to be reported at a control point. Includes calculated average monthly loadings & concentrations for a period of 36 months

4 - Raw data file
  - providing storage for each individual result received

5 - Parameter descriptor
  - containing descriptive data of parameters, methods of analysis etc.

The system also has the facility to:

- calculation of loading from analysis and flow data submitted to the Ministry;
- storage and fast retrieval of all analysis results and loadings;
- accumulation and production of monthly average statistics;
- storage and reporting of flow data such as total flow, maximum flow, minimum flow, etc;
- storage and reporting of miscellaneous data as follows:
    - bypass at plant
    - bypass within sewer system
    - bypass primary treated
    - sludge volume
    - chlorine used
    - pre-chlorination
    - post-chlorination
    - 15-minute chlorine residual
    - bacti counts
    - aeration data

This data is stored and reported monthly.

Data Flow

Two types of data are required by the System:

A) Fixed Data

B) Monitoring Results

Fixed Data

This data is generated by the Regional field staff. When a plant is built the Control points and parameters to be reported are determined. The "Fixed Data Forms" are completed and sent to Head Office for keypunching and entry into the system. The "Fixed Data Update" produces a descriptive report of the plant, Control Points and Parameters. The report is sent to the Field Staff with a copy retained at Head Office.

Monitoring Results

The samples taken by the plant are mailed to the Regional Office as required. The samples are analysed and the results entered on the "Monitoring Results Forms" and sent to Head Office. The results are keypunched and entered.by the "Monitoring Results Update".

APPENDIX 5

WASTE SITE INFORMATION SYSTEM

Background

In 1978 a feasibility study was done by Systems Development Section on a Waste Site Information System. The feasibility study recommended that because of the number of Branches involved and the range of information required, the best approach to develop a Waste Site System would be to break it up into several phases, and develop it by phase.

The development of Phase I was initiated in November 1979 and was completed in Systember 1980.

System Description

The overall objectives of the Waste Site Information system is to develop a centralized inventory of all waste sites in the Province. The final phase that has been completed will gather all information of the various waste sites in the Province and produce a master file. It is expected to be completely updated by the summer of 1981. The inventory data kept on the master file identifies the sites - Certificate of approval number, location, lot, concession, operation, owner, municipality, waste category and controlling system.

Data Flow

When an application is submitted for a Waste Site the Regions check the data to make sure all the information required is completed.

If there is no hearing to be held and the Regions approve the site they complete the computer inventory form and send it to the Environmental Approvals Branch to be entered into the system.

If there is a hearing then the application is sent to the Environmental Approvals Branch, and after the hearing is held and the site is approved the Environmental Approvals Branch completes the inventory form and enters it into the system.

APPENDIX 6.

INDUSTRIAL LIQUID WASTE WAYBILL SYSTEM

Background

Data on the transfers of Liquid Industrial Waste in Ontario was previously entered and stored in "Wang" word-processing equipment. This was found to be very restrictive in the manipulating of the data to produce meaningful statistics and reports.

The "Liquid Waste Waybill System" was developed and implemented in 1979.

The data is entered on a daily basis and the system now contains data dating from August 1979.

Objectives

The major objectives of the system are:

- to facilitate Ministry control over transfers of Liquid Industrial Wastes in accordance with Ontario regulation 926/76. More specifically, the system is responsible for reconciliation of Source and Receipt notes submitted to the Ministry by producers and disposers of Liquid Industrial Wastes.

- to provide management and statistical information to assist the Ministry in the development and setting of policy procedures.

System Description

Shipping Notes are mailed to the Ministry by the generator (source) of the waste at the time it is picked up.

Receipt Notes are mailed to the Ministry by the receiver (mainly waste sites) upon delivery of the wastes.

The Shipping and Receipt Notes are received by the W.M.B. and entered directly into the system via the Branch Terminal.

The Waybill data is stored on a file until such time that a reconcile is desired. The reconciliation procedures match the Shipping and Receipt Notes on Waybill number. In addition the waste codes, quantity and units are compared. If they are not equal the latest record is stored and the previous record rejected. This serves as a means for correcting data that had previously been entered incorrectly.

The Shipping and Receipt Notes that are not matched are stored on the "Unmatched Master File".

Data from matched Shipping and Receipt Notes are merged into 1 record and stored on the "Matched Master File". Various statistical and information reports have been developed and are produced on an "On Request" basis.

Report Types Available

The reports currently available can be broken down into two categories as follows:

- Standard System Reports
- On-Request Retrievals

Standard System Reports

The following reports are produced by the waybill inputting and reconciliation procedures and are used by the Waste Management Branch's clerical staff for follow-up and error correcting.

1. Input Edit Report

   This report is produced in the sequence in which the waybills are entered. All data entered are displayed.

   When an error occurs the error condition and the waybill is identified.

   The waybill can then be extracted from the batch, corrected and re-submitted.

2. Daily valid transactions

   This report lists all valid shipping and receipt notes entered into the reconciliation procedures. The report is in waybill number sequence.

   The purpose of the report is to provide a reference as to 'if and/or when' a waybill has been entered.

3. Record of Unmatched Receipt of Shipping Notes

   This report is a print-out of all records on the unmatched file. In addition the number of days overdue is calculated and displayed. The report is produced in source name sequence for follow-up by the branch or regions.
   A summary is produced at the end of each source detail report

On-Request Retrievals

This category is broken down into two sections as follows:

- Regional/Head Office Reports
- Management Reports

Regional/Head Office Reports

1. Regional Status Report on the unmatched file.

   This report displays the totals of unmatched shipping and receipt notes and the associated gallon totals for each region. In addition the overall totals are shown.

2. Summary of Outstanding Shipping and Receipt Notes.

   This report provides the totals of unmatched shipping and receipt notes by carrier. The purpose of this report is to highlight carriers with high unmatched or non-delivered records.

   This report can be used in conjunction with Report-3 and 4 below.

3 & 4. Details of Unmatched Shipping and Receipt Notes

These reports provide detailed information of the outstanding shipping and receipt notes. The purpose of these reports is to provide the detailed data required for follow-up with the carrier.

These reports can be used in conjunction with Report-2 above.

NOTE: Reports 1, 2 and 3 above can be produced in the following sequences:

- Carrier No. only
  (for Management and Head Office Procedures)
- Carrier No. within Region
  (for Regional follow-up and procedures)

Reports 4 and 5 below can only be produced on source name sequence as source numbers and region codes have not been allocated to date.

5. Summary of Unmatched Receipt Notes

This report provides totals of outstanding receipt notes where matching shipping notes have not yet been received.
The purpose of this report is to highlight the sources who are not submitting their shipping notes.

This report can be used in conjunction with Report-6 below.

The sequence of this report is source name.

6. Detail of Unmatched Receipt Notes

This report provides detailed information of each receipt note for which a matching shipping note has not been received.

The report is produced in source name sequence for follow-up purposes.

This report can be used in conjunction with Report-5 above.

7. Matched Way-bills

This report provides details of wastes delivered to a site where the shipping and receipt notes have been reconciled. The two major sequences of this report are:

- Site No. Only
  (for Management and Head Office Procedures)
- Site No. within Region
  (for Regional Procedures)

NOTE: All the above reports provide final totals of the number of shipping and receipt notes and the associated quantities of waste.

In addition totals by Region are provided on Regional requests.

Management Reports

The following is a brief synopsis of the Management Reports to be produced:

1. Source Reports:

   (1) Source/Waste site Activity Report showing Waste detail organized by Waybill No. within Waste Site delivered to, within Source.

   (2) Source/Carrier Activity Report showing Waste detail organized by Waybill No. within Carrier, within Source.

   (3) Source Summary Report showing waste code totals by Source.

2. Carrier Reports:

   (4) Carrier/Source Activity Report showing Waste detail organized by Waybill No. within Source, within Carrier.

   (5) Carrier/Waste Site Activity Report showing Waste detail organized by Waybill No. within Waste Site, within Carrier.

   (6) Carrier Summary Report showing waste code totals by Carrier.

3. Waste Site Reports:

   (7) Waste Site/Source Activity Report showing Waste detail organized by Waybill No. within Source, within Waste Site.

   (8) Waste Site/Carrier Report showing Waste detail organized by Waybill No. within Carrier, within Waste Site.

   (9) Waste Site/Disposal Method Activity Report showing Waste detail organized by Waybill No. within Disposal Method, within Waste Site.

   (10) Waste Site/Transfer Activity Report showing Waste detail organized by Waybill No. within transfer site, within Waste Site.

   (11) Waste Site Summary Report showing waste code totals by Waste Site.

4. Waste Code Reports:

(12) Waste Code Activity Report showing Waste detail organized by Waybill No. Three reports i.e. Waste Characteristics by carrier, source and site.

(13) Waste Code Summary Report showing waste code totals by Waste Code.

The selection criteria to be used in defining the content of the report to be produced are as follows:

(1) Time Period
(2) Area
(3) Source
(4) Carrier
(5) Waste Site
(6) Disposal Method
(7) Transfer Code
(8) Waste Code

APPENDIX 7.

INDUSTRIAL PERFORMANCE MONITORING SYSTEM

Background

The I.P.M.S. was developed and implemented in 1972.

Originally the system was developed according to the requirements of the Industrial Wastes Branch.

With the re-organization of the Ministry the system was taken over by the Pollution Control Branch.

The system was suspended in 1976 as the Pollution Control Branch did not have the manpower required to support it.

Approximately 80 companies were submitting data at the time of the suspension.

The volume of data submitted varied depending on the size of the company.

System Description

The I.P.M.S. stores and processes data mainly on industrial discharges direct to watercourses in Ontario. In addition data that is deemed as essential such as: in-plant processing chemicals used, etc. are stored and processed.

The data is stored in 4 master files as follows:

1 - Industry Descriptor

2 - Control Point Descriptor

3 - Monitoring Summary

4 - Raw Data

"Fixed Data" (Refer. Data Flow below) is used to create Files 1 and 2 and the "fixed" part of 3. Result data submitted by industries are converted to monthly loadings, monthly concentrations are calculated and the 2 totals stored in a "Monthly Bucket" in the "Monitoring Summary Record". All result data is stored in "Monthly Result Records" in the "Raw Data File".

Data Flow

There are two types of data required by the system as follows:

1. Fixed Data
2. Monitoring Results

Fixed Data

These data are generated by the Ministry of the Environment field staff. A company is visited and the control points and parameters to be reported determined. The "Fixed Data Forms" are completed and sent in to the Head Office for keypunching and entry into the system. The "Fixed Data Update" produces a descriptive report of the company, control points and parameters. A copy of this report is maintained at Head Office and a copy sent to the Field Staff.

Monitoring Results

The analysis results of samples taken by the company are entered on the "Monitoring Results Forms" and mailed to the Ministry of the Environment's Head Office or Regional Office as required. Result data is keypunched and entered via the "Monitoring Results Run" at the Ministry Head Office. An "Exception and Delinquency Report" is produced and sent to the Regional Office for follow-up.

APPENDIX 8.

EXAMPLES OF APPLICATION AREAS BY CATEGORY

Category 1 Application Areas

Process Controller

The main purpose is to assist in a production process as an integral component of that process. This may involve data collection, analysis, monitoring, control and reporting, usually in a real time operating mode (e.g., Laboratory Instrument Monitoring System).

Message Controller

A message controller is a special process control application involving the processing and switching of messages. A message controller may be at either end or in the middle of a message network.

Equipment Controller

An equipment controller is a special process control application involving a component unit of a larger computer such as a channel, a drive, memory or some of the functions of the central process unit itself.

Terminal Controller

Terminal controllers combine the functions of a message controller and equipment controller into one piece of equipment. Both remote job entry and intelligent terminals are in this application area.

Electronic Accounting Machines

Electronic accounting machines can be viewed as a special type of equipment controller but with limited programming capability and no master file data storage capability. They are usually provided as a turnkey installation. Magnetic strip ledger card systems are a good example of this usage.

Key Data Entry Systems

Key data entry systems are a special type of equipment controller with a programmable data entry/validation capability using a special purpose language. Temporary data storage is provided on disk, diskette, or on tape with output capability usually on tape. These special purpose systems are evolving constantly and presently they may include full RJE terminal, data transmission and general purpose computing capability.

Word Processing Systems

Word processing systems are a special type of data entry system with the emphasis on textual data updating, correction and formating via special function keys or commands which control a dedicated word processing program. Temporary output occurs on a display device or a printer with temporary storage on a tape, cassette, disk or diskette. Final output is on printer or on tape, cassette, diskette or transmission for further processing such as typesetting.

Category 2 Application Areas

Limited Purpose Commercial Systems

These systems usually provide specific limited commercial processing services for a small number of commercial applications which cannot adequately or economically be serviced by some other alternative. Two main examples of these types of systems are the use of mini-computers in a geographically remote location or the use for static self-contained applications. (e.g., a dedicated on-line Order Entry System).

Limited Purpose Scientific Systems

These systems usually provide limited processing capabilities and software to solve scientific, engineering, economic, or financial problems of a mathematical nature. The systems may be used in either a batch or time sharing interactive mode using FORTRAN, BASIC, APL, or a manufacturer's unique language. The time shared mode is usually preferred because it provides responsive service to its users of shared resources. The multitude of mini-computer based time-sharing service bureaus are typical of this approach.

Distributed Processing System

Distributed processing is an approach to computing whereby the data processing, data storage and systems development functions are distributed between a central data centre and one or more remote processing sites in the most appropriate manner. A data communications network is an essential element of such an approach as it connects the various processing sites together so as to achieve an integrated systems capability. The new on-line terminal based banking systems are an example of this approach.

Category 3 Application Areas

Batch Commercial Systems

These are complex dynamic systems which usually have many large programs requiring constant maintenance. They usually require large input/output

capability which occurs at an uneven or unpredictable time, hence making a shared resource environment desirable. Furthermore, their size and complexity usually indicates that they require a full comprehensive range of services possibly including specialized equipment such as COM and OCR. A moderate size organization's accounting systems such as General Ledger, Accounts Receivable, Accounts Payable and Payroll is a good example of this application area.

Batch Scientific Systems

These systems are similar to the commercial systems. The programs are usually large and complex, but may use standard programs or subroutines hence the need for a comprehensive availability of such products. The emphasis is on processing capability rather than input/output capability. The workload is often uneven and unpredictable hence making a shared resource environment desirable. Also specialized input/output equipment such as plotters or graphic display devices may be required. A technical organization's engineering analysis and design systems is an example of this application area.

Data Base/Data Communication Systems

These systems are characterized by a large number of interrelated and integrated files serving multiple users requiring access to these large files of global data. The system currently or in the near future will be supporting many terminals in an on-line data communications mode. The complexity and dynamics of these systems necessitates the use of a reliable data centre that provides comprehensive services.

oOo

APPENDIX 9.

COMMUNICATION COSTS

MONTHLY COST TO VARIOUS CITIES FOR T.S.O.

(terminal running steady for 1 hour a day) at 300 BPS

D A T A P A C

	D.D.D. Toll Charge	Access Charge	Kilopak Charge	Total Cost	Dedicated Line Charge
Hamilton	$276	60	+ 18.80	= $78.80	$121
London	444	60	+ 20.00	= 80.00	140
Kingston	468	60	+ 35.80	= 95.80	150
Sudbury	540	60	+ 44.20	= 104.20	163
Thunder Bay	648	60	+ 194.40	= 254.40	238
Don Mills	Nil	60	+ 16.80	= 76.80	(48.60) dial up

Access Charge (D.D.D.):
- Telephone Line $15:00 per month
- Modems $21.25/month

MONTHLY COST TO VARIOUS CITIES FOR R.J.E.

(20 day month)

costed at 1 & 2 hours a day at both 2400 & 4800 BPS

1 hr day = 1200 mins.
2 hr day = 2400 mins.

Dedicated line cost and break even points

- at 2400 BPS

	Infoexchange	Ded. Line	Breakeven
Hamilton			
1 hour (1200)	$332	$376	1 hr., 25 mins/day (1700 min.)
2 hours(2400)	440		
London			
1 hour	368	510	2 hrs., 5 min/day (2500 min.)
2 hours	500		
Kingston			
1 hour	368	584	2 hrs, 39 min/day (3180 min.)
2 hours	500		
Sudbury			
1 hour	410	689	2 hrs, 40 min/day (3200 min.)
2 hours	578		
Thunder Bay			
1 hour	530	1204	3 hrs, 33 min/day (4260 min.)
2 hours	794		
Don Mills			
1 hour	332	210	4 mins./day
2 hours	440		

4800 BPS

	Infoexchange	Ded. Line	Breakeven
Hamilton			
1 hour (1200)	$548	$562	1 hour, 5 min/day (1300 min.)
2 hours (3400)	704		
London			
1 hour	632	758	1 hour, 33 min/day (1860 min.)
2 hours	860		
Kingston			
1 hour	632	870	2 hours, 3 min/day (2400 min.)
2 hours	860		
Sudbury			
1 hour	710	1031	2 hours, 7 min/day (2540 min.)
2 hours	998		
Thunder Bay			
1 hour	908	1843	3 hours, 7 min/day (3740 min.)
2 hours	1352		
Don Mills			
1 hour	548	210	
2 hours	708		

APPENDIX 10
ROLE OF THE SYSTEMS REVIEW BOARD IN THE MINISTRY OF THE ENVIRONMENT

CONTENTS

1. Goal and Functions
2. Process
3. Output
4. Input
5. Initial Meeting
6. Regular Meetings
7. Ad-Hoc Meetings
8. Reporting

APPENDICES

1. Procedures
    (a) Work Request Preparation
    (b) Project Proposal Preparation
    (c) Maintenance Project Plans
    (d) Rating and Ranking Procedure
    (e) Master Plan Schedule Preparation
2. PAC 11 Reporting System

EXHIBITS

1. List of Project Priorities
2. Master Plan Schedule Worksheet
3. Master Plan Schedule
4. Work Request Form
5. Project Proposal Form
6. Maintenance Project Plan Form
7. Project Proposal Log
8. Project Progress Report
9. PAC11 Executive Project Summary

1. Goal and Functions

The major goal of the Systems Review Board is to determine how best to utilize the systems resources of the Ministry and to be able to respond quickly to new needs and changing priorities as they occur throughout the year.

The major functions of the Board are to:

- assess, prioritize and rank work requests and project proposals
- assess systems resources and determine appropriate allocations
- review overall progress of current projects and approve plans incorporating new projects

These functions will necessarily cover the drawing-up and approval of annual systems plans and decisions with respect to major policy and procedure changes.

2. Process

Although the Board is mainly concerned with the prioritizing and ranking of projects there are a number of procedures required to provide the Board with the information it needs to make decisions. These procedures and the role of the Board, the various User Branches and the Systems Development Section may be summarized under the following headings:

Work Request/Project Proposal Preparation

The User Branches in conjunction with the Systems Development Section prepare various proposals identifying needs, objectives, and preliminary cost estimates. The preparation of Work Requests, Project Proposals, and Maintenance Project Plans are described in Appendices 1(A), 1(B), and 1(C).

Depending on the cost estimate involved the following courses of action may be taken:

- if smaller than $5,000 the Systems Development Section will prioritize, rank and schedule the work to be done
- if medium, between $5,000 and $15,000, the Systems Development Section in conjunction with the User Branch will prioritize, rank and schedule the work in accordance with the allocation of systems resources outlined in the annual systems plans
- if larger than $15,000, the Board will prioritize and rank the proposal.

Submission of Proposals

In the case of large proposals, over $15,000, written submissions along with the necessary documentation, for example, feasibility studies, requests for proposals, proposal evaluation reports, etc., must be forwarded to the Chairman of the SRB at least 2 weeks in advance of the next regular meeting of the Board for inclusion on the agenda.

In the case of urgent proposals requiring action before the next scheduled meeting of the SRB, the Chairman at his discretion may schedule an ad-hoc meeting.

Presentation of Proposals

The presentation to the SRB on all large proposals over $15,000 will be made by the Director of the User Branch mainly responsible for the proposal. The presentation will be based on the documents submitted to the Board. Technical support will be provided by the Systems Development Section as required.

Priority Setting

After the presentation of proposals has been completed the SRB will then determine the priority category to be assigned to each proposal. The priority categories are as follows:

A - Essential

B - Very Important

C - Important

D - Other

In the case of disapproved or deferred proposals notice will be distributed to the appropriate User Branch Director.

Ranking

Before ranking of the new proposals begins the current 'List of Project Priorities' is reviewed and the rankings either confirm or adjusted. Then the first proposal appearing in the A-category is compared to the previously ranked no. and the question asked, "If there are only funds for the coming year to fund one of these two projects, which one will it be?" After discussion a decision is made as to which is the superior project. Similiarly the other A-category projects are compared with the project previously chosen as not superior. Upon completion of the ranking of the A-category projects, the B,C and D-category projects are ranked.

Upon completion of the ranking procedure a new 'List of Project Priorities', a 'List of Project Priorities' by Division and the minutes of the meeting are prepared for distribution.

The priority setting and ranking procedure is described in detail in Appendix 1 (C)

Master Plan Schedule Preparation

Upon completion of the priority setting and ranking of projects by the SRB the Systems Development Section will develop a Master Plan Schedule. This is done by posting on a Master Plan Schedule Worksheet the current projects, resource allocation and schedule and then in light of remaining resources posting each of the new projects, resource allocation and schedule. After all of the current and new projects have been scheduled on the Worksheet the results are transferred to the Master Plan Schedule Form showing each project as a bar graphically illustrating the anticipated start and end times. The Master Plan Schedule is then distributed to the members of the SRB for comment. Upon review the SRB may decide to reconsider priorities and rerank projects.

Once the schedule has been set a Summary Description is prepared for all first-year projects and is distributed to the User Branches throughout the Ministry.

The Master Plan Schedule Preparation procedure is described in Appendix 1(e).

3. Output

The output from the SRB meeting consists of the following documents:

- new List of Project Priorities identifying projects and their order of priority (EXHIBIT 1.)
- new List of Project Priorities by Division
- minutes of the SRB meeting covering discussions of proposals and other major policy and procedure items
- new Master Plan Schedule Worksheet identifying projects and resource allocations (EXHIBIT 2)
- new Master Plan Schedule identifying projects in order of priority and showing their estimated start and finish times (EXHIBIT 3)
- Summary Descriptions of first-year projects.

4. Input

The input to the SRB meeting consists of the following documents:

- Work Requests identifying the project, the system or subject concerned and summarizing the problem or objective to be met (EXHIBIT 4)

- Project Proposals identifying the project and summarizing the objectives, project description, benefits and potential problems (EXHIBIT 5)

- Maintenance Project Plan identifying the project, the system or subject concerned and describing the project and work required (EXHIBIT 6)

- Project Proposal Log identifying projects, user sponsor, actions taken and preliminary cost estimates (EXHIBIT 7)

- Project Progress Report identifying the project, progress made, tasks completions not met, task completions planned for next period and associated problems (EXHIBIT 8)

- current Master Plan Schedule identifying projects, start and finish dates for 5-year period

- other major policy and procedure items

- PAC 11 Executive Project Summary identifying projects, budgets, costs to date, start and finish times (EXHIBIT 9).

5. Initial Meeting

The initial meeting of the SRB would be largely of an introductary nature and would be structured as follows:

- brief review of Spectrum-1 and its implementation status across the Government and in the Ministry of the Environment
- review of SRB role, priority setting and ranking process and the documents involved
- brief review of current projects
- priority setting and ranking of current projects

The last items to be covered in the meeting would consist of:

- introduction of new proposals to be prioritized and ranked in the first regular meeting of the SRB
- scheduling of an Ad-Hoc Meeting which would consist of a presentation on the Laboratory Information System to be made by Digital Method Ltd. of Ottawa.

6. Regular Quarterly Meetings

Regular quarterly meetings of the SRB have been tentatively scheduled as follows:

- April 30
- July 30
- October 30
- January 30

The April 30 meeting would emphasize the previous fiscal year-end wrap-up and the beginning of the new fiscal year with respect to current and new projects.

The July 30 meeting would emphasize new proposals and status of current projects.

The October 30 meeting would emphasize the preparation of annual systems plans (estimates) for the next fiscal year with respect to on-going and new projects.

The January 30 meeting would emphasize the availability of funds with respect to current and new projects over the last 2 months of the fiscal year.

7. Ad-Hoc Meetings

Ad-Hoc meetings of the SRB will be called by the Chairman of the Board to deal with emergencies, project proposals that cannot wait for the next regular meeting of the Board, or large projects requiring decisions at the SRB level. Two examples of large projects requiring special meetings in the 1978/79 fiscal year were the Laboratory Information System and the Nanticoke Environmental Management Program.

8. Reporting

The Systems Development Section will prepare a monthly report for the Chairman of the SRB covering progress on current projects, new work being proposed, and major policy and procedure items. The report will consist of the following documents:

- Systems Development Narrative summarizing progress on current projects, new work requests and project proposals, and other relevant items

- PAC-11 Executive Project Summary Report showing the status of projects under-way and scheduled. An overview of PAG-11 is provided in Appendix 2.

APPENDICES

APPENDIX 1 (A)

WORK REQUEST PREPARATION

The Work Request Form EXHIBIT 4 is filled out by the User-Branch identifying the project, the system or subject concerned and summarizing the problem or objective to be met. Upon approval within the User Branch the Work Request Form is then forwarded to the Systems Development Section for completion with respect to the type of work involved, the corresponding action to be taken and the estimated cost of action to be taken.

If the estimated cost of action to be taken is less than $5,000 the Systems Development Section will prioritize, rank, approve and schedule the action to be taken.

If the estimated cost of action to be taken is greater than $5,000 but less than $15,000 and is also in line with the resources allocated to the User Branch then the Systems Development Section in conjunction with the User Branch will prioritize, rank, approve and schedule the action taken.

If the estimated cost of action to be taken is greater than $5,000 and in addition to the resources allocated to the user branch, or the estimated cost of action to be taken is greater than $15,000, the Work Request will be forwarded to the Chairman of the S.R.B. for inclusion on the agenda of the next S.R.B. meeting.

Ontario

Work Request

Instructions: – Complete your section of the form.
– Return completed form to the Systems Branch.
– Systems will complete their section and return it to you advising the type of work requested, action taken and estimated cost.

For Systems Use Only Project Code
Include All Attachments Page of
Date of Request
Revision Number

Project Name, if any

System Name or Subject Description. Include Client Reference Code, if applicable.

Summary of Problem or Objective. To include impact on existing functions, systems, and procedures; anticipated benefits; and project completion criteria. Attach supporting documents.

Requested Due Date

Requesting Organization	Client Mailing Address
Originated By (Print Name) / Phone Number	Approved By (Print Name) / Phone Number
Job Title	Job Title
Signature / Date	Signature / Date

Type of Work Requested and Action Taken - For Systems Branch Use Only – Check (√) one Box

Type of Work	Corresponding Action Taken
☐ Consulting	– Prepare Terms of Reference
☐ Information Retrieval	– Produce Report
☐ [illegible]e Development	– Prepare Proposal
☐ [illegible]all Development	– Prepare Plan
☐ Planned Maintenance	– Prepare Plan
☐ Emergency Maintenance	– Rectify Problem
☐ Other – Specify type of work and action taken in area at right.	

Other Type of Work

Corresponding Action Taken

Client if any discord notify Systems immediately

Estimated Cost of Corresponding Action Taken

$

Assigned to	Date Assigned	Date Due	Authorized by

APPENDIX 1 (B)

PROJECT PROPOSAL PREPARATION

The Project Proposal Form (EXHIBIT 5) is filled out by the Systems Development Section in conjunction with the User Branch identifying the project and summarizing the objectives, project description, benefits and potential problems. The project proposal is then forwarded to the Systems Development Section and a preliminary cost estimate prepared. The proposal is then returned to the User Branch for follow-up approval.

If the preliminary cost estimate is less than $15,000 but in line with the resources allocated to the User Branch then the Systems Development Section in conjunction with the User Branch will prioritize, rank, approve and schedule the action taken upon receipt of the Project Proposal Form containing the appropriate disposition signatures.

If the preliminary cost estimate is greater than $15,000 then the Project Proposal Form containing the appropriate disposition signatures will be forwarded to the Systems Development Section for review with the Chairman of the Board and inclusion on the agenda of the next meeting of the S.R.B.

[redacted] P[redacted]ECT [redacted]POS[redacted]

Project Name	Proposal No.	Priority	
		Class	Number

Project Objectives

Project Description

Benefits (Indicate How Calculated)

Potential Problems (During Development and During Operation)

Required Or Directed(By Whom)

Preliminary Cost Estimate	Recommendation	Prepared By	Date	Revision No.

7540-1217

APPENDIX 1 (C)

MAINTENANCE PROJECT PLANS

The Maintenance Project Plan (EXHIBIT 6) is filled out by the User Branch identifying the project, the system or subject concerned and describing the project and work required. The form is then forwarded to the Systems Development Section for estimates preparation.

If the total project cost estimate is less than $5,000 the Systems Development Section will prioritize, rank, approve and schedule the action to be taken.

If the total project cost estimate is less than $15,000 but in line with the resources allocated to the User Branch then the Systems Development Section in conjunction with the User Branch will prioritize, rank, approve and schedule the action to be taken.

If the total project cost estimate is greater than $5,000 and in addition to the resources allocated to the user branch, or the total project cost estimate is greater than $15,000 the Maintenance Project Plan will be forwarded to the Chairman of the S.R.B. for inclusion on the agenda of the next S.R.B. meeting.

Ontario

☐ Planned
or
☐ Emergency

Maintenance Project Plan and Acceptance

Note: If Planned Maintenance, complete entire form.
If Emergency Maintenance, complete only portion of form. Eliminate entire 'Estimates' section as well as 'Estimates Accepted and Project Authorized'. However, fill in field "Actual Total Project Costs".

Project Code

Project Name, if any	Include All Attachments Page of
System Name or Subject Description. Include your Client Reference Code, if applicable.	Date of Request
	Revision Number

Project Description. Clearly state the work required to rectify the problem or meet the objective outlined on the original work request. Attach supporting documents.

Estimates –

Human Resources Costs	Computer Costs	Other Costs	Sum of first three Boxes Total Project Costs	Change in Operating Costs (+ or –) /year
$	$	$	$	$

Submitted by (print name)	Job Title	Signature	Date

Estimates Accepted and Project Authorized ☐ Yes ☐ No - To be completed by Client and returned to Systems Branch

Client (print name)	Job Title	Signature	Date

Comments:

Project Schedule and Actual Results - To be completed by Systems Branch

Scheduled Start Date	Scheduled Completion Date		
Actual Start Date	Actual Completion Date	Actual Total Project Costs $	Change in Operating Costs (+ or –) /year $

Project Acceptance by Both Systems and Client

Quality Reviewed by Systems (print name)	Job Title	Signature	Date
Project Accepted by Client (print name)	Job Title	Signature	Date

Additional Comments:

APPENDIX 1 (A)

WORK REQUEST PREPARATION

The Work Request Form EXHIBIT 4 is filled out by the User-Branch identifying the project, the system or subject concerned and summarizing the problem or objective to be met. Upon approval within the User Branch the Work Request Form is then forwarded to the Systems Development Section for completion with respect to the type of work involved, the corresponding action to be taken and the estimated cost of action to be taken.

If the estimated cost of action to be taken is less than $5,000 the Systems Development Section will prioritize, rank, approve and schedule the action to be taken.

If the estimated cost of action to be taken is greater than $5,000 but less than $15,000 and is also in line with the resources allocated to the User Branch then the Systems Development Section in conjunction with the User Branch will prioritize, rank, approve and schedule the action taken.

If the estimated cost of action to be taken is greater than $5,000 and in addition to the resources allocated to the user branch, or the estimated cost of action to be taken is greater than $15,000, the Work Request will be forwarded to the Chairman of the S.R.B. for inclusion on the agenda of the next S.R.B. meeting.

PROCEDURE MANUAL

Section	Page	Date
6.1.3	2 of 4	11/15/76

SUBJECT: RATING AND RANKING PROCEDURES

Forms Used

PC 179 List of Project Priorities

Procedures

The rating and ranking procedures are to be performed by the Systems and Programming Manager unless delegated to another individual. The decisions will be made by a quorum of the Systems Review Board.

(1) At least two weeks prior to the meeting of the Systems Review Board, submit summary materials describing each of the project proposals to be considered to the members of the Systems Review Board so they may prepare themselves for the subsequent priority setting.

(2) It is recommended that a cork board (or its equivalent) be secured and a piece of cardboard measuring approximately 3 x 12 inches containing the name of a project proposal, together with its number and estimated cost, be prepared. Prepare one cardboard for each existing proposal in the Master Systems Plan and for each new project being proposed.

(3) To accomplish the rating, it is suggested that triangular tent cards bearing the designations A, B, C, and D be placed on the table in the meeting room and each project proposal summary be read to the Systems Review Board and the Systems Review Board's decision secured on which category that proposal will be placed in. This process is repeated for each of the proposals until all of them are resident in one of the four classifications. If a proposal is rejected (disapproved) or deferred, indicate this action on the back side of the Project Proposal in the boxes provided.

(4) To proceed with the ranking procedures, pin the 3 x 12 inch cardboard with the project proposal names for all items that were previously in the plan to the left-hand side of the cork board in the sequence in which they ranked last time as recorded on the List of Project Priorities.

(5) Ask for confirmation on the priority ranking as it exists on the cork board. Any changes that are requested are executed by rearranging the priority sequence on the board.

(6) All new project proposals ranked in the "A" group are then considered. Taking the first of the new proposals, the cardboard description is held aloft along with the cardboard strip containing the name of the proposal previously ranked number one. Then ask the Systems Review Board the following straightforward question: "Let us assume that there are only funds for the coming year to fund one of these two projects, which one will it be?" Discussion of the Systems Review Board members is encouraged. Following the discussion request a decision on which of the proposals is considered superior. Place the one chosen as superior at the right-hand side of the cork board in the top position and continue the process with the remaining proposals being compared with the proposal that was not not selected in the first round. In a similar manner, use all proposal cards for this comparison including all the new proposed projects that are entering the plan for the first time.

(7) In a similar manner, the "B" projects are then ranked and placed below the list of "A" projects. Systems Review Board members are requested to examine this more complete listing and, if any switches in priority are desired, this is done by changing the sequence of the cardboard strips.

(8) When all the proposals in the "A" and "B" sections have been completed, record the sequences on the List of Project Priorities Form PC 179. On the List of Project Priorities, enter the date of the Systems Review Board meeting and check the box indicating "company". List the number and name of all the project proposals in priority sequence, including those from the previous list.

(9) Normally the "A" and "B" groups will account for one to two years' worth of projected workload, and it is not necessary to use the time of the Systems Review Board for ranking of the "C" and "D" projects. These latter projects are normally ranked by the Systems and Programming Manager based on his judgment of where the executives have placed their priorities.

(10) After all ranked proposals have been recorded on the List of Project Priorities, prepare individual lists by department. Check the box indicating "department" and enter the name of the department.

(11) Prepare minutes of the meeting summarizing decisive points resulting from the meeting. Attach a copy of the List of Project Priorities both for the company and by department.

LIST OF PROJECT PRIORITIES	Date
_____ Company	_____ Department

Order of Priority	Project Number	Name

7540-1284

APPENDIX 1 (E)
MASTER PLAN SCHEDULE PREPARATION

PROCEDURE MANUAL

Section	Page	Date
6.1.4	1 of 3	11/15/76

SUBJECT MASTER PLAN SCHEDULE PREPARATION

Purpose

Once the Systems Review Board has placed all Project Proposals into priority sequence, it is essential that the impact of these decisions be displayed in the form of a schedule showing the approximate calendar time when the projects will be funded and implemented. This procedure contains the steps to accomplish the preparation of that schedule.

Policy

A Master Plan Schedule will be prepared each time the Systems Review Board reranks Project Proposals and the schedule will be kept up to date.

Related Materials

(1) Revised listing of project priorities as part of the Systems Review Board minutes
(2) Budget and resource levels available to the department

Forms Used

(1) PC 200 Master Plan Schedule Form
(2) PC 201 Master Plan Schedule Worksheet

Procedures

The schedule will be prepared by the Systems and Programming Manager.

(1) Using the Master Plan Schedule Worksheet, post the current year at the top of one worksheet and the year of each of the next five years at the top of four additional worksheets. On the line labeled "Available Dollars", post the monthly dollar budget of the department for systems and programming staff for each month for the current year and for the following four years (see Figure 1).

Supersedes Procedure Dated	Prepared By	Approved By
6/2/75		

(2) List each of the project names in priority sequence from the List of Project Priorities prepared as described in Section 6.1.3. Start the list with projects that have already been funded. Opposite each project name post the rate per month of the Project Team that is expected to work on that project. The rate per month is arrived at by taking the expected number of individuals assigned to the project and multiplying by the standard billing rate per hour for all staff and multiplying this in turn by 140 hours per month.

(3) Starting with all active projects and continuing to the first listed project, post the number of dollars consumed by the Project Team (rate per month) in each month until the project's estimated dollars have been exhausted. If any partial dollars remain, post them in the last month of the project.

(4) On scratch paper calculate the remaining balance for each month by subtracting the cumulative total for posted projects from the available dollars at the top of the column. In a manner similar to the first project, post the dollar expenditures for the next project in each successive month until the project total is exhausted, making sure the posting does not cause the cumulative total to exceed the available.

(5) Continue in a similar manner for each listed project, always starting the project in the month funds are available and terminating the project after the estimated amount of the project has been posted. If a range of dollars is shown on the proposal, use maximum estimates for each of these schedules.

(6) Move from sheet to sheet as necessary until either five years have been posted or all the projects have been scheduled.

(7) Using the Master Plan Schedule Form, mark the date in the upper right-hand corner of the form and list all project or proposal names and numbers in the same sequence that they were listed on the worksheet (see Figure 2).

(8) By observing the month and year on the worksheet that each project or proposal is slated to begin and to end, prepare a bar or Gantt chart showing graphically the timing of the anticipated implementation of each of the present or proposed projects.

(9) When the schedule is complete, distribute it to members of the Systems Review Board for their comments. If the comments indicate that the schedule causes them to reconsider their priority rankings, then a special meeting of the Systems Review Board should be called to accomplish this reranking. Once the reranking is performed, this procedure is then repeated and a new schedule is prepared and distributed.

(10) Once the schedule has been set, prepare a summary description of the first year's projects and distribute to all members of the data processing staff (perhaps by placing on the bulletin board) and to all management members who have a direct interest in the implementation dates of proposed projects. Write this description in letter form with a header line for each paragraph indicating the name of the project and the anticipated starting date of the work followed by one paragraph describing each project.

MASTER PLAN SCHEDULE WORKSHEET

Year													
Project	Rate /Mo.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Available Dollars													

MASTER PLAN SCHEDULE

AS OF _____

No	PROJECT NAME	19____				19____				19____				19____				19____			

7540-1305

PC 200

APPENDIX 2
PAC 11 REPORTING SYSTEM

SECTION I - PAC II OVERVIEW

Introduction

PAC II is a computer software product specifically designed to aid in the management of projects of all kinds. The system consists of a series of computer programs written in ANS COBOL. The heart of the system is a sequentially organized data base that is served by these programs. They maintain the data base and retrieve information from it. Because of its unique design and in-core processing the system executes very quickly.

PAC II covers the full range of project management requirements; yet only those areas specifically required need to be addressed. The many features of PAC II may be implemented incrementally or totally. They provide for the budgeting, planning, monitoring, and costing of all aspects of project management. By design it is easy to use and understand.

PAC II has full resource scheduling capabilities. Any kind of resource can be scheduled. Commitment levels of resources can be full or partial. They can be linear or non-linear. The system can schedule with individual resources, group resources or unlimited resources. These resources can be scheduled based on priority, availability and/or network dependencies. Network dependencies may be single or multiple and can cross project lines (Inter-Project Dependencies).

PAC II has full project scheduling and planning capabilities. It can schedule projects based on priority, resource availability and/or network dependency. Single or multiple projects can be scheduled. Organizational divisions can be scheduled. These projects can be of all types and include maintenance as well as new developments.

PAC II functions based on parameters specified by the user on the System Function Control Entry. The selection of features, output and run frequency is user controlled at run time. The system can operate with or without a data base. It also easily simulates varying alternatives without requiring data base changes to examine the impact on the original plan.

PAC II creates output as required. Only those outputs that are specifically requested are produced. All planning reports are generated by a single program and all control reports are generated by a single program. These reports are presorted to eliminate distribution problems.

PAC II Control Reports have been carefully structured to bring the proper information forward for timely action. An automatic 'flagging' feature highlights projected variances to control budgets and dates. PAC II Planning Reports readily point out the projected utilization of resources; individually, collectively and by project. The information hierarchy covers all levels. Each reporting resource receives a forecasted schedule of activities,

PAC II has been designed for user customization. Virtually all user customization can be accomplished without program change. The system can accommodate a standard activity directory. It can also function without it. PAC II will support any user defined project identification system and any user defined project hierarchy. No pre-definition is made in these areas.

PAC II can do all these things and more. It does them quickly and easily.

EXHIBITS

EXHIBIT 1
LIST OF PROJECT PRIORITIES

LIST OF PROJECT PRIORITIES	Date
_____ Company	_____ Department

Order of Priority	Project Number	Name

7540-1284

MASTER PLAN SCHEDULE WORKSHEET

Year												
Project	Rate / Mo.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Available Dollars													

EXHIBIT 2
MASTER PLAN SCHEDULE WORKSHEET

MASTER PLAN SCHEDULE

AS OF _____

No	PROJECT NAME	19____				19____				19____				19____				19____			

EXHIBIT 3
MASTER PLAN SCHEDULE

7540-1305

PC 200

Ontario

Work Request

EXHIBIT 4

Instructions: — Complete your section of the form.
— Return completed form to the Systems Branch.
— Systems will complete their section and return it to you advising the type of work requested, action taken and estimated cost.

For Systems Use Only
Project Code

Project Name, if any

Include All Attachments
Page of

.em Name or Subject Description. Include Client Reference Code, if applicable.

Date of Request

Revision Number

Summary of Problem or Objective. To include impact on existing functions, systems, and procedures; anticipated benefits; and project completion criteria. Attach supporting documents.

Requested Due Date

equesting Organization

Client Mailing Address

Originated By (Print Name) Phone Number

Approved By (Print Name) Phone Number

ob Title

Job Title

Signature Date

Signature Date

Type of Work Requested and Action Taken - For Systems Branch Use Only — Check (√) one Box

Type of Work	Corresponding Action Taken
☐ Consulting	— Prepare Terms of Reference
☐ Information Retrieval	— Produce Report
☐ arge Development	— Prepare Proposal
☐ all Development	— Prepare Plan
☐ lanned Maintenance	— Prepare Plan
☐ Emergency Maintenance	— Rectify Problem
☐ Other — Specify type of work and action taken in area at right.	

Other Type of Work

Corresponding Action Taken

Client if any discord notify Systems immediately
Estimated Cost of Corresponding Action Taken
$

ssigned to | Date Assigned | Date Due | Authorized by

PROJECT PROPOS[illegible]

Project Name	Proposal No.	Priority	
		Class	Number

Project Objectives

Project Description

Benefits (Indicate How Calculated)

Potential Problems (During Development and During Operation)

Required Or Directed(By Whom)

Preliminary Cost Estimate	Recommendation	Prepared By	Date	Revision No.

7540-1217

PC 105

EXHIBIT 5

PROJECT PROPOSAL DISPOSITION

	Signature	Title	Date	Remarks
Recommendations				

Action

- ☐ Approved
- ☐ Disapproved
- ☐ Action Deferred Until (Date)

Systems Review Board

Signature _____ Date _____

Approval To Activate	Project Manager Assigned	Date
Other Instructions		Target Date For Project Plan

EXHIBIT 6

Ontario

☐ Planned
or
☐ Emergency

Maintenance Project Plan and Acceptance

Note: If Planned Maintenance, complete entire form.
If Emergency Maintenance, complete only portion of form. Eliminate entire 'Estimates' section as well as 'Estimates Accepted and Project Authorized'. However, fill in field "Actual Total Project Costs".

Project Code	
Project Name, if any	Include All Attachments Page of
System Name or Subject Description. Include your Client Reference Code, if applicable.	Date of Request
	Revision Number

Project Description. Clearly state the work required to rectify the problem or meet the objective outlined on the original work request. Attach supporting documents.

Estimates –

Human Resources Costs	Computer Costs	Other Costs	Sum of first three Boxes Total Project Costs	Change in Operating Costs (+ or –)
	$	$	$	$ /year

Submitted by (print name)	Job Title	Signature	Date

Estimates Accepted and Project Authorized ☐ Yes ☐ No - To be completed by Client and returned to Systems Branch

Client (print name)	Job Title	Signature	Date

Comments:

Project Schedule and Actual Results - To be completed by Systems Branch

Scheduled Start Date	Scheduled Completion Date		
Actual Start Date	Actual Completion Date	Actual Total Project Costs $	Change in Operating Costs (+ or –) $ /year

Project Acceptance by Both Systems and Client

Quality Reviewed by Systems (print name)	Job Title	Signature	Date
Project Accepted by Client (print name)	Job Title	Signature	Date

Additional Comments:

PROJECT PROPOSAL LOG

Proposal Number	PROPOSED PROJECT	Date Request Submitted	Assignment Approval	Date Assigned	Date Due	Assigned To	USER SPONSER	Preliminary Cost Estimate	Proposal Approval	Date Submitted To SRB	Action

7540-1282

EXHIBIT 7
PROJECT PROPOSAL LOG

EXHIBIT 8
PROJECT PROGRESS REPORT

PROJECT PROGRESS REPORT

FOR PERIOD ENDING _____

PROJECT TITLE		PROJECT NUMBER
PREPARED BY	APPROVED BY	DATE

PROGRESS MADE AND TASKS COMPLETED THIS PERIOD

TASK COMPLETIONS NOT MET AND WHY

TASK COMPLETIONS PLANNED FOR NEXT PERIOD

PROBLEMS WHICH MAY ADVERSELY AFFECT SCHEDULES, COSTS OR PROJECT OBJECTIVES

7540-1003

EXHIBIT 9

SYSTEMS DEVELOPMENT SECTION * * * * PAC 11 EXECUTIVE PROJECT SUMMARY * * * * * PAGE 1

PAC_11_ PROJECT MANAGEMENT * EXECUTIVE PROJECT SUMMARY *

DATE: APR 17,79-1 * PERIOD ENDING APR 14,79 *

PROJECT DESCRIPTION / DEPARTMENT / IDENT.	COST SUMMARY ORIGINAL BUDGET	REVISED BUDGET	TO DATE ACTUAL	TIME SUMMARY ORIGINAL ESTIMATE	REVISED ESTIMATE	TO DATE ACTUAL	DATE SUMMARY ORIGINAL START DATE	ORIGINAL FINISH DATE	REVISED START DATE	REVISED FINISH DATE	STATUS
CAPITAL FINANCE WILL SYS 102-017-00	2,170		998	100		46	APR 2,79	MAY 24,79			ACTIVE
URIS MODIFICATIONS 102-018-00	11,626		396	540		18	APR 2,79	OCT 4,79			ACTIVE
HAZARDOUS CONTAM. PH.1,2 202-019-00	23,209		852	1,078		39	APR 2,79	NOV 28,79			ACTIVE
AIR RESOURCE MINI FEAS. 202-021-00	1,550		486	72		22	APR 2,79	MAY 8,79			ACTIVE
SIS MAINTENANCE 203-001-00	2,015		43	1		2	APR 2,79	MAR 31,80			ACTIVE
WATER WELLS MAINTENANCE 203-002-00	1,085			1			APR 2,79	MAR 31,80			ACTIVE
WATER TAKING MAINTENANCE 203-003-00	775			1			APR 2,79	MAR 31,80			ACTIVE
SIS LIMNOLOGY DATA CONV. 203-014-00	3,100		710	144		33	APR 2,79	JUN 21,79			ACTIVE
GRAND R. SIMULATION MODL 203-020-00	6,200		180	288		8	APR 2,79	AUG 14,79			ACTIVE
WATER QUAL. RECD. SYST 203-022-00	2,325		262	108		12	APR 2,79	DEC 24,79			ACTIVE
UTIL LONG RGE REQ MAIN. 204-005-00	3,100			1			APR 2,79	MAR 31,80			ACTIVE
UWPAS MAINTENANCE 204-006-00	3,100			1			APR 2,79	MAR 31,80			ACTIVE
PESTICIDES MAINTENANCE 204-007-00	3,100		10	2			APR 2,79	MAR 31,80			ACTIVE

SYSTEMS DEVELOPMENT SECTION

PAC IT PROJECT MANAGEMENT

DATE: APR 17,79-1

EXECUTIVE PROJECT SUMMARY

PERIOD ENDING APR 14,79

PROJECT DESCRIPTION / DEPARTMENT / IDENT.	COST SUMMARY ORIGINAL BUDGET	COST SUMMARY REVISED BUDGET	COST SUMMARY TO DATE ACTUAL	TIME SUMMARY ORIGINAL ESTIMATE	TIME SUMMARY REVISED ESTIMATE	TIME SUMMARY TO DATE ACTUAL	DATE SUMMARY ORIGINAL START DATE	DATE SUMMARY ORIGINAL FINISH DATE	DATE SUMMARY REVISED START DATE	DATE SUMMARY REVISED FINISH DATE	STATUS
UWPMS METRICATION & RET 204-010-00	6,200		1,440	288		66	APR 2,79	JUL 6,79			ACTIVE
ENVIR ASSMT PMS MAINTEN. 205-004-00	2,325			1			APR 2,79	MAR 31,80			ACTIVE
REGIONAL DATA PROC NEEDS 301-016-00	9,000		374	1		17	APR 2,79	MAR 31,80			ACTIVE
UPMS MAINTENANCE 304-008-00	3,100			1			APR 2,79	MAR 31,80			ACTIVE
LABORATORY INFORM. SYS. 306-015-00	15,000		1,722	2		80	APR 2,79	MAR 31,80			ACTIVE
EXP RESOURCE RECOV PLANT 401-013-00	6,200			1			APR 2,79	MAR 31,80			ACTIVE
IWPMS MAINTENANCE 402-009-00	3,100			1			APR 2,79	MAR 31,80			ACTIVE
WASTE SITE DESCRIPT MOD. 402-011-01	6,200		223	70		10	APR 2,79	APR 26,79			ACTIVE
WASTE SITE COST ANALYSIS 402-011-07	1,550			1			APR 1,79	MAR 31,80			ACTIVE
LIQ WASTE WAY BILL SYS. 402-012-00	6,200		1,395	288		64	APR 2,79	JUN 20,79			ACTIVE
****PROJECTS TOTAL****	122,230		9,091	2,991		422					
INDIRECT (OVERHEAD) 000-800-00	990		1,016	59		144	MAR 30,79	JUN 21,79			ACTIVE
OTHER (OVERHEAD) 000-900-00	1,205		1,677	70		124	MAR 30,79	JUN 22,79			ACTIVE
****GEN/ADM TOTAL ****	2,195		2,693	129		269					
**** TOTAL ****	124,425		11,784	3,120		691					

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